

INSIDE: **CAN HISTORICAL SITES SURVIVE THE REC BOOM?**

Montana Outdoors

MONTANA FISH, WILDLIFE & PARKS | \$4.50

MAY-JUNE 2022

BEAVERS

Busy storing water for
the dry times ahead



IN THIS ISSUE:

TEAMING UP TO SAVE WATER

COUNTING FISH WITH A FACE MASK

YOU HEARD RIGHT: YUMMY SMOKED GOLDEYE BURGERS

DISCOVERING "PENNSYLVANIA" STREAMS IN MONTANA



Montana Outdoors

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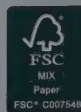
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Montana Outdoors

MAY-JUNE 2022

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Conservation-minded ranchers helped save trout and Arctic grayling by giving up precious water during last year's record-breaking drought.

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IMMERSIVE RESEARCH Writer Brianna Randall emerges from the water after snorkeling in Rattlesnake Creek near Missoula. See her story on page 36 about how biologists use snorkeling to survey fish numbers and habitat use. Photo by Rob Roberts.

FRONT COVER Beaver dams store runoff, cool and filter water, trap silt, reduce downstream flooding, check erosion, create wildlife habitat, and slow the spread of wildfire. Did we miss anything? See our story starting on page 18 to find out. Photo by Jeremie Hollman.

Thank you, Dave

We so enjoyed the essay "Hunting with a Friend," by Dave Books and illustrated by Stan Fellows in your November-December 2021 issue. This same type of friendship develops between many Montana landowners and hunters, but it's rare to see it expressed in such a beautiful and meaningful story. My parents set the example for me when I grew up in the Canton Valley near Townsend. Dave's story reminded me of the many lifelong friends my parents made with hunters who came to hunt pheasants in the valley (now underwater beneath Canyon Ferry Lake). My husband Bob and I are enrolled in the Block Management Program, and over the years we have visited with many hunters who appreciate the convenience this opens to them. Thank you, Dave, for showing the wonderful friendship you shared with Richard Stuker, who must have been a very special man.

Gay Ann Masolo
Winston

Backward bighorns?

I read your September-October cover article about reintroducing bighorns ("Cautiously Bringing Bighorns Back"), and it seems to me that your biologists have it completely backward. The sheep that have survived past



those on Wild Horse Island. And why would you even consider killing "chronic shedders" when those are the very sheep that have evolved to resist infection?

The answer, of course, is that shedders might infect other, more vulnerable sheep, which we've already spent countless hours and millions of dollars trying to protect. Too bad. Mother Nature says those sheep aren't fit to survive. If all the sheep in Montana were shedders, we might be issuing thousands of tags a year instead of a handful. This is what we get for playing doctor to wild sheep in the first place, and now we've painted ourselves into a corner. I would very much like to hear how your biologists respond.

Bill Hoffman
Kalispell

Brian Wakeling, chief of the Wildlife Division's Game Management Bureau, responds: I agree that it

shedders," as they are called, are as dismal at recruiting their young into the population as the other sheep in the same herd. Young are often the most susceptible to pneumonia, and recruitment—getting young sheep to survive to age one—is among the challenges for herd persistence in infected sheep. A lot of research is taking place on this topic, some of which is occurring in Montana by FWP and others in cooperation with the Wild Sheep Foundation and the Montana Wool Growers Association. Right now, the scientific evidence is more supportive of removing animals that are spreading the disease rather than retaining them in hopes of establishing a disease-resistant herd.

Photo issue fans

One of my favorite things in the whole world is opening your annual photo issue. It makes me giddy with joy to see so much beauty in one place. Thank you for all the hard work that must go into picking those gems. I save every photo issue every year and have always wondered if you could put out a book with all the photos. Maybe as a fundraiser? Put me on the waiting list. These photos are phenomenal, and a compilation would be wonderful to own.

Laureen McCarthy
Fortune

Thank you for once again publishing your wonderful photo issue that celebrates in pictures so many of Montana's incredible scenic and wildlife wonders. We are so lucky to live here, and that issue is a regular reminder of our good fortune.

Marianne Peterson
Billings

I'm a native Montanan who appreciates all that Montana has to offer. I greatly appreciate your publication, in particular the photo issue. It's absolutely magnificent. I return to my home state every summer to meet old friends and fish the Musselshell River, Smith River, and many small streams throughout Montana. Please continue to keep the state whole, safe, beautiful, and unspoiled.

John McGuin
Hockessin, DE

Editor's explanation

Many readers called or emailed asking why their March-April issue was late. The main reason was that our printer was unable to obtain sufficient paper in time. A recent issue of the trade magazine Publisher's Weekly sums up the problem: "If the early days of 2022 have been any indication, paper shortages and rising distribution costs are challenges that the industry will likely face throughout the year. The seeds of the current problems were sown in the years of the pandemic, when sales of print books unexpectedly rose, increasing demand while people were leaving manufacturing jobs in droves that led to labor shortages in the printing and papermaking businesses."



“Why would you even consider killing “chronic shedders” when those are the very sheep that have evolved to resist infection?”

infectious disease outbreaks are precisely the ones you should be reintroducing, like those from the Missouri Breaks, not sheep that have never seen the diseases, like

would be great if we could breed bighorn sheep that were immune to pneumonia and passed that immunity along to their offspring. The problem is that these “chronic

Smoked Goldeye Burgers

By David Schmetterling | Preparation time: 7-8 days (drying, brining) | Smoking time: 5-6 hours | Cooking time: 8 minutes | Serves 2-3



INGREDIENTS

Brine

- 1 gallon water
- ½ c. soy sauce
- 1 yellow onion, diced
- 3-5 cloves of garlic, diced
- 1 c. kosher salt
- ½ c. brown sugar
- ¼ c. maple syrup
- 2 T. ground black pepper
- 2 T. dill
- 1 T. rosemary
- 1 t. thyme
- 12 bay leaves

Burgers

- 2 c. flaked, smoked goldeye
- 3 beaten eggs
- 1 c. breadcrumbs
- 2 T. minced onion
- 3 cloves garlic, minced
- 1 t. hot sauce
- Salt and pepper to taste

DIRECTIONS

Combine brine ingredients in a large stock pot or saucepan, heat, and stir to dissolve. Let cool.

Add the whole (gutted and descaled) goldeye. Stir once per day for three days. Remove the goldeye and rinse them in cold water and pat dry (inside and out).

Dry and smoke (see instructions at left).

After smoking, flake the meat off the bone and combine with the other burger ingredients in a bowl. Form into 4 or 5 patties and grill about 4 minutes per side. Serve as you would any burger. ■

If you ever fish the lower Missouri or Yellowstone rivers, you'll definitely catch goldeye—whether you want to or not. These aggressive native fish, which resemble herrings, will eat almost anything they can get their little toothy mouth around, from a dry fly to a large chunk of cut bait. They're fun to catch on light tackle or a fly rod.

Most anglers in Montana release these foot-long fish, having heard the flesh is bony and mushy.

It is, if not handled right. But in other parts of North America, goldeye are a prized food fish, especially when smoked. Smoked goldeye are an iconic food of Manitoba. Fort Peck Reservoir once had a commercial fishery for the species.

Each spring when I go catfishing, I keep a dozen or so goldeye for the smoker. Just like with a pronghorn, once you kill a goldeye you want to quickly cool it down. I gut mine but otherwise keep them whole. A bottle cap screwed to a dowel works well for scraping off the scales before the fish go into a cooler on ice. This keeps the flesh firm.

Once home, I brine whole fish for three days, then rinse, pat dry, and keep them in the refrigerator to dry out for another four or five days before smoking. This ensures formation of the thin, shiny glaze, called a pellicle, on the skin. I smoke the fish for about five to six hours over apple wood, starting at 140 degrees F and gradually increasing the temperature each hour to 175 degrees F for the last hour.

After cooling the fish to room temperature, you can eat them as is. I like to flake off a couple of cups of meat, make it into patties, and grill them like burgers, served with all the fixings.

—David Schmetterling is the FWP Fisheries Research Program coordinator in Missoula.



All in for water conservation

It looks like we're in for another dry summer. As this issue of *Montana Outdoors* goes to press in mid-April, snowpack is below or far below normal for most of Montana, with predictions of continued severe or extreme drought. That could change with some heavy late-spring snows, but I wouldn't bet on it.

Here's what that means for Montana's fish, wildlife, and outdoor recreation—and what all of us can do to help.

Last year was Montana's driest in more than two decades. By October, 100 percent of the state was in severe drought and 70 percent was in extreme drought. Fort Peck Reservoir was so low that some boat ramps were left high and dry. Trout numbers in the upper Clark Fork River reached record lows. The drought also hammered prairie ponds. These family-friendly fisheries experienced lower water levels, higher water temperatures, and low dissolved oxygen that in some cases led to fish kills.

Record low flows in the Smith River last year forced us to impose "hoot owl" restrictions far earlier than normal to protect already stressed trout. We also had to place these restrictions, which close fishing from 2 p.m. to midnight, on eight other popular rivers, including the Missouri below Holter Dam, Madison, upper Yellowstone, Stillwater, and Beaverhead. By late July, we actually had to close fishing entirely on the Gallatin and Jefferson and part of the Big Hole.

Even in northwestern Montana, the state's wettest region, below-normal snowpack contributed to low streamflows for bull trout, a federally threatened species that needs even colder and cleaner water than most other trout species to survive.

As for wildlife, our biologists tell me that terrible range conditions led to poor nutrition and reduced survival for many elk, deer, and pronghorn. Wetlands dried up, reducing places for waterfowl and shorebirds to nest and decreasing nesting success. Green areas of grasslands where sage-grouse, sharp-tailed grouse, and pheasant chicks usually find insects in summer dried up, too. Some upland bird hunters told me that 2021 was their worst season ever.

Now we're looking at more of the same conditions, if not worse, for the rest of 2022.

Montanans can't make more rain or snow, but all of us can

conserve water to keep as much moisture on Montana's landscape as possible. Last summer I met Big Hole ranchers doing just that.

Several years ago, they entered into special agreements that required them not to use some of their water rights, in order to keep more water in the river and its tributaries to help Arctic grayling. In return, the U.S. Fish & Wildlife Service agreed to ease any new restrictions if the species is ever federally listed. That program was a main reason the USFWS decided in 2020 not to list the grayling as an endangered species.

Here's something that really impressed me: The Big Hole at Wisdom went completely dry in the drought of 1988, but it still had water in 2021, an even worse drought year. Not a lot of water, but enough for trout and grayling to survive (see photo and story starting on page 30).

Keeping water in streams and rivers benefits all Montanans and visitors, including landowners, kayakers, trout guides and anglers, and anyone who uses community water supplies. Out of that shared benefit comes recognition of the need for shared sacrifice. Some ranchers and farmers give up part of their precious irrigation water; anglers forego fishing opportunities during hoot owl or total closures; people in towns and cities water their lawns less and use low-flow faucets.

Protecting wetlands helps, too. These wet areas act as sponges, absorbing and storing spring runoff to feed streams and grow lush vegetation in summer.

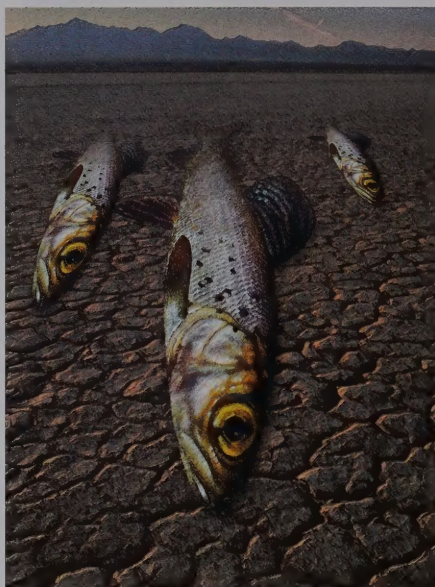
Helping make all this happen are dozens of local watershed groups that bring together a wide range of people to find ways to preserve water for the benefit of all.

Last summer I was encouraged by the willingness of landowners, anglers, biologists, the local watershed group, and others in the Big Hole Valley to work together. I came back to Helena inspired and hopeful. It seems to me that if diverse interests can come together and conserve water on the

Big Hole, they can do it elsewhere, too.

If you or your community want to learn how to conserve water for the good of Montana, call this number and we'll put you in touch with the right people to help: (406) 444-2449.

—**Hank Worsch**, Director, Montana Fish, Wildlife & Parks



Montanans can't make more rain or snow, but all of us can conserve water to keep as much moisture on Montana's landscape as possible.

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Westslope cutthroat trout

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JOHN WARNER

FISH FARMER

CORY HAGEMEISTER

Manager, Miles City Hatchery

I'M SHOWN HERE with my two fish culturalists, Josh Culver on my right and Tori Swope, sitting on the tank. Starting in June, we'll also have two summer seasonal workers as we transition to using the 49 ponds outside at our 150-acre facility. Here at FWP's Miles City Hatchery we raise mostly walleye and largemouth bass, and also tiger muskies, yellow perch, bluegills, channel catfish, fathead minnows, and federally endangered pallid sturgeon. The walleye are stocked mainly in Fort Peck Reservoir, and the bass and most of the other species go all over the state, as far away as ponds west of Kalispell.

This job is a good fit for me because I grew up near Miles City on a farm-ranch, so I've been raising animals all my life. I started out here as a seasonal worker in 1995-96, then moved to Idaho to get

trained in fish culture before working at remote hatcheries in Alaska for nine years and finally returning to this hatchery in 2011.

One of the most important things we do here is raise pallid sturgeon. After they reach 6 to 8 inches long, we stock them in the upper Missouri River around Loma and Fort Benton. This summer we're hoping to get some 4-foot-long adults that we can spawn, and then raise fingerlings to provide to federal hatcheries in Bozeman, North Dakota, and South Dakota.

We also like that our work contributes to fishing recreation across Montana. When we hear about a family that had a great weekend catching fish in a pond or lake that we stocked, either locally or on the other side of the state, that's a real rewarding feeling. 🐟



Freelance photographer **Charlie Bulla** was driving across some badlands near Winnett just after dawn one June morning when he came across this gulch, lit by the early morning sun. "I was on a photo assignment for the Theodore Roosevelt Conservation Partnership, shooting a wildlife habitat project in central Montana, and this scene stopped me in my tracks," says Bulla, who had just finished a course at the Rocky Mountain School of Photography in Missoula. "I spent about two hours there without moving my vehicle. I'd never seen anything like how that dark green contrasted with the light green, and all the depth back in there. That scene was all about light, and I tell you that light lit me up that morning just like it lit up the landscape. I still can't believe I was in such a beautiful place." ■





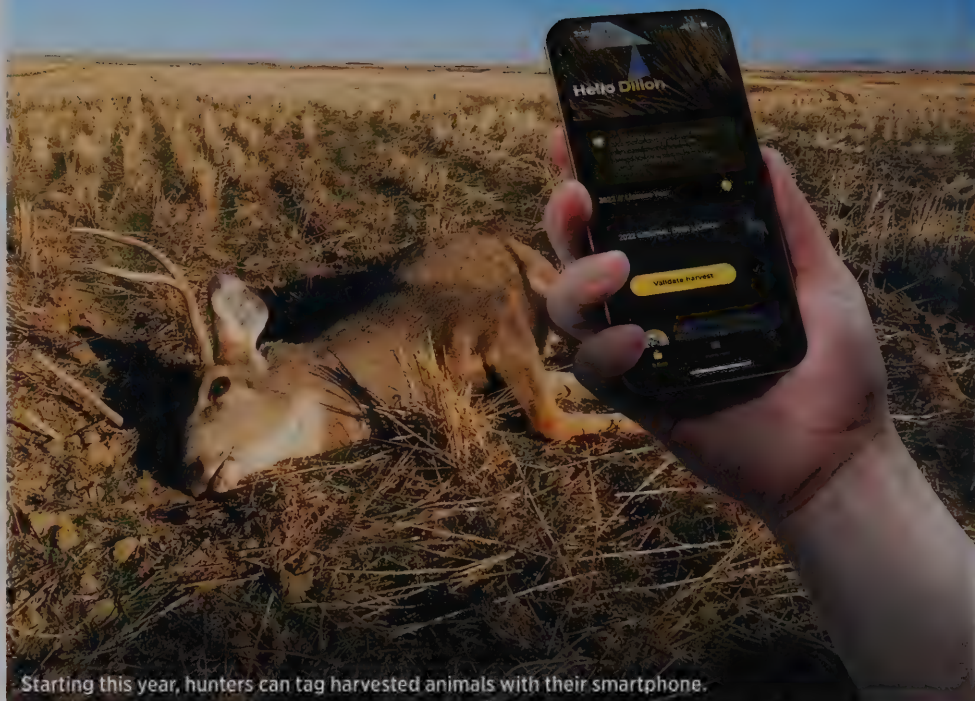
While walking along the Silver Bow Creek Greenway Trail in Butte in late May, **Lea Frye** spotted this sora rail hiding in reeds next to open water. "It was the day after one of those late-spring snowstorms, and all sorts of birds were down along the creek getting water," says Frye, a professional wildlife photographer in Helena. "I got down on the ground as low as I could, and then just sat there quietly waiting until it moved out to where I could get a good shot. I was happy to get this particular image of it raising its foot. Sora rails have such big feet, and I always like to show an animal's distinctive features in my photographs." ■





2.39

Weight, in pounds, of the state record Utah chub caught at Canyon Ferry Reservoir on March 7 by Steve Hagan of East Helena



Starting this year, hunters can tag harvested animals with their smartphone.

FWP CUSTOMER SERVICE

FWP launches new license and tag phone app

Successful big game hunters can now tag their animal in the field with a smartphone.

That service and more are available on the new MyFWP app, launched March 1. The app provides an easy way to store and display licenses, permits, and digital carcass tags, known as E-Tags. The app is available in Apple's App Store and Google Play.

"We created MyFWP to be a major convenience for hunters and anglers," says Hank Worsech, FWP director.

In addition to storing and displaying

licenses and permits on their phone, MyFWP gives hunters the option to digitally tag a harvested animal instead of using a traditional paper tag—even if the hunter is outside of cell service range.

Hunters can choose between digital or paper versions for each license they buy online or at an FWP office. They can't choose both, however, and the decision is final for the remainder of the license year for each license. For hunters who choose a digital license, their E-Tag for each species will be available on their mobile app to download to their phone before heading into the field.

Even those opting for paper carcass tags can still use MyFWP to carry and view licenses and permits for the current and previous year.

FWP is also working on new functions and services for the MyFWP app, including hunter harvest reporting.

Learn more at fwp.mt.gov/myfwppapp. ■



Former FWP director takes helm of USFWS

On March 8, Martha Williams was sworn in as director of the U.S. Fish & Wildlife Service by Interior Secretary Deb Haaland, having served as principal deputy director of the 8,000-person federal agency for more than a year.

The former FWP director (2017–2020) and legal counsel (1998–2011) was nominated by President Joe Biden in October and confirmed by the U.S. Senate in February, with the support of U.S. Senators Steve Daines and Jon Tester. "Martha's strategic vision and collaborative approach will be key as the Department of the Interior works to conserve, connect, and restore America's lands, waters, and wildlife for current and future generations," Haaland said at the ceremony.

STATE PARK HISTORY

Play at a park, then learn something important

Montana's state parks offer stunning scenery and diverse hiking, fishing, camping, boating, and other outdoor recreation. Many also protect and interpret significant historical and cultural sites, from pioneer ghost towns to Native American buffalo jumps.

For instance, Council Grove, set in an old-growth ponderosa pine forest along the Clark Fork River, is one of 13 state parks honoring American Indian culture. It is the site of the 1855 Hellgate Treaty between the Salish, Kalispel, and Kootenai Indians and the U.S. government that established the Flathead Reservation. Under the treaty, the tribal leaders reluctantly ceded ownership of more than 20 million acres to the United States but reserved the perpetual right to use ceded



Roughly 40 miles south of Helena up a winding dirt road off Interstate 15, Elkhorn is just one of several ghost town state parks rich in pioneer and mining culture, history, and architecture.

lands for traditional cultural and subsistence purposes such as hunting and fishing.

Visitors interested in Old West and mining history can choose from eight parks, including Elkhorn, where several structures retain their pioneer architectural charm.

Lewis and Clark fans can learn about the Corps of Discovery at Missouri Headwaters, Travelers' Rest, and five other state parks.

Plan your next historical or cultural state park visit at fwp.mt.gov/activities/culture-and-history. ■

Elk management advisory group dives in

A newly formed citizen advisory group has begun work shaping the future of elk management and hunting in Montana. The group's 12 members, from across Montana, represent a broad range of viewpoints and experience but don't officially represent any specific organizations. They will focus on two tasks: (1) develop a set of recommendations to address elk management issues, and (2) improve relationships among hunters, landowners, and others affected by elk and elk management.

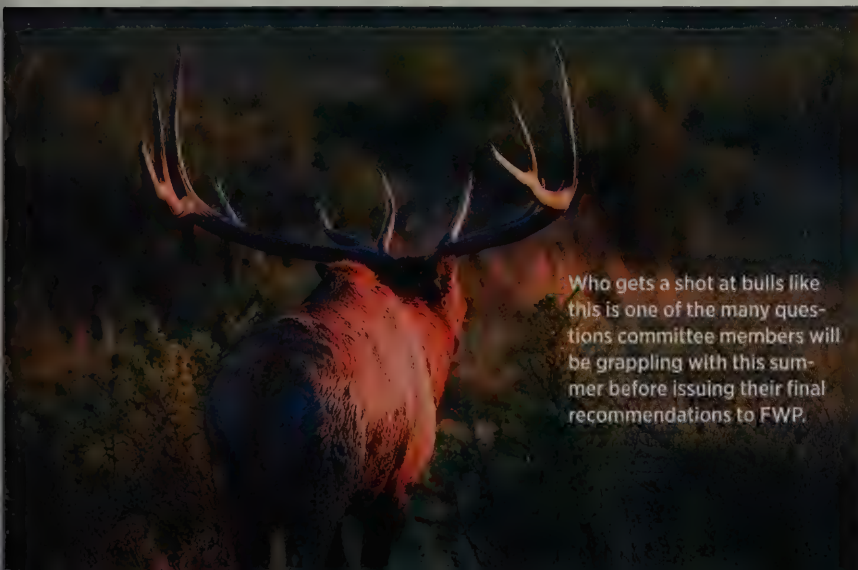
The advisory group held its first virtual meeting March 22 and will meet nine more times before presenting final recommendations to FWP director Hank Worsch at the end of July. All meetings are available for public viewing. "The quality of applicants was tremendous," Worsch says. "With so many people interested in helping out, the fairest way to select members was to focus on the experience of each applicant and their willingness to work with others to find solutions."

Among the issues the group will address are public access on private land, allocation of hunting opportunities, and burgeoning elk populations in many parts of the state.

"The challenge I'm asking this group to take on will be tough, but I'm convinced that they will work together to come up with lasting solutions," Worsch says.

Any of the 232 applicants who weren't selected will be able to participate as members of a "sounding board," to attend every meeting and review and provide feedback on the advisory group's work throughout the process.

For more information and to watch future meetings, visit fwp.mt.gov/aboutfwp/elk-management-citizen-advisory-group. ■



Who gets a shot at bulls like this is one of the many questions committee members will be grappling with this summer before issuing their final recommendations to FWP.

FWP VIDEO SHOWCASE

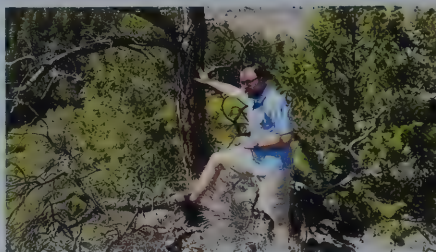


Recent videos produced by FWP staff for social media and television



The crAy Team

One in a series of playful videos produced by the FWP Fisheries Division for Instagram and other social media. This week's episode: "Are crayfish safe to eat?"



Where To Find Bats

Montana bat expert Matt Bell explains why rock crevices and not caves are actually the best spots to locate these winged mammals.



Montana's Wild Dogs

FWP education specialist Corie Rice talks about Montana's four canid species—swift fox, red fox, coyote, and wolf—and what they all have in common as well as their unique characteristics.



OUTDOORS JUST FOR KIDS

By Brett French. Illustration by John Potter

Owls can turn their heads almost completely around. Why and how do they do this?

Owls need to swivel their heads because their eyes can't move back and forth like ours can. If you keep your head still, you can still look a bit to the left and to the right. Owls can't do that. So they have adapted to turn their head instead.

Owls have twice as many bones in their neck—called vertebrae—compared to humans. Owls have 14 neck vertebrae, while humans have 7.

There's a groove where those neck bones meet the owl's skull that allows their head to swivel. Humans have two in the same place. One way to think about that is to imagine standing on two swivel chairs, with a foot on each chair. It's hard, and unsafe, to swivel very far with a foot on each chair. But if you are standing on one swivel chair, it's much easier to turn around.

Owls can turn their head 270 degrees, or three-quarters of the way around. If they are looking straight ahead, they can turn their head to the left and continue turning, looking completely



backward, and even continue on toward the right side. They could turn that far around in the other direction, too.

If humans tried that, the blood supply that travels through our neck to our brain would get cut off. Owls have wider holes in their neck bones that keep the blood vessels from being pinched. Also, blood flows into pools in the base of the bird's head. That blood then flows to its eyes and brain even while the head turning cuts off some blood flow from the heart.

Montana bird watchers have found 14 different owl species in the state. They range from the tiny northern pygmy owl to the large snowy owl, which only visits our state in the winter. All are able to swivel their head 270 degrees around. ■

Brett French is the outdoors editor at the Billings Gazette. John Potter is an artist and illustrator in Red Lodge. See other "Outdoors Just for Kids" columns at billingsgazette.com.

Spotted Knapweed

Centaurea stoebe

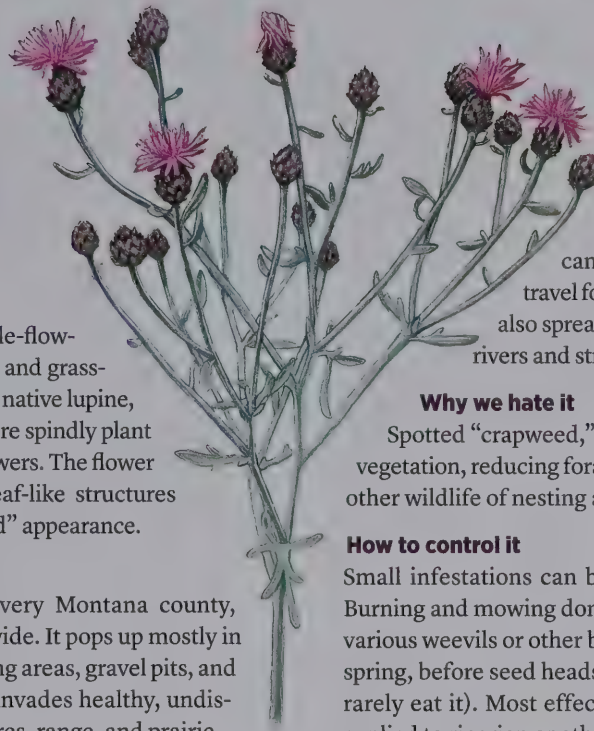
What it is

Spotted knapweed is a weedy purple-flowered plant that can take over range- and grass-lands. From a distance it looks like a native lupine, but closer examination reveals a more spindly plant with lavender or pink thistle-like flowers. The flower heads are surrounded by small leaf-like structures called “bracts” that create a “spotted” appearance.

Where it's found

Spotted knapweed is found in every Montana county, infesting 2 to 5 million acres statewide. It pops up mostly in disturbed soils at mining and logging areas, gravel pits, and construction sites. The plant also invades healthy, undisturbed plant communities in pastures, range, and prairie.

Illustration by Liz Bradford



How it spreads

Spotted knapweed disperses via its abundant production of seeds, anywhere from 500 to 4,000 per plant, that take root in any disturbed ground. Seed heads can get caught in vehicle undercarriages and travel for hundreds of miles before dispersal. Seeds also spread in hay, gravel, and road fill and by way of rivers and streams when the plant grows along banks.

Why we hate it

Spotted “crapweed,” as some people call it, muscles out native vegetation, reducing forage for livestock, elk, and deer and robbing other wildlife of nesting and cover habitat.

How to control it

Small infestations can be eradicated with careful hand pulling. Burning and mowing don't work. There's been some success using various weevils or other biocontrols. Grazing by goats and sheep in spring, before seed heads form, can keep infestations down (cattle rarely eat it). Most effective are broad-leaf herbicides (not to be applied to riparian or other environmentally sensitive areas). ■

Learn more about noxious weed control at mtweed.org.

THE MICRO MANAGER

“Management Plans”

A quick look at a concept or term commonly used in fisheries, wildlife, or state parks management.

FWP managers often preface statements with “according to our management plan” or “based on our management strategy” when recommending certain actions. That can puzzle anglers, hunters, and others who wonder why a plan developed years earlier guides management decisions today.

Management plans and strategies are documents that guide decisions for five, ten, or even more years. They bring together historical and contemporary information, and then project likely scenarios and the best actions by FWP staff for managing the species, park, or fishery under different conditions.

For example, the Upper Missouri River Reservoir Fisheries Management Plan, last updated in 2020, lists abundance and angler catch rate goals for various game fish species in reservoirs near and downstream of Townsend. It then outlines

management strategies, such as adjusting perch and walleye harvest regulations under certain conditions, for achieving those goals.

During the multiyear process of developing or updating a management plan, various drafts are released for public review and comment. FWP considers all public comments and recommendations, as does the Montana Fish and Wildlife Commission, which reviews and approves all FWP management plans. Once approved, a new or updated plan gives FWP managers a roadmap for deciding how best to manage elk, for instance, or the Bighorn River.

Existing management plans can't be altered, ensuring that FWP analysis and public input approved by the Fish and Wildlife Commission are respected and considered. But the plans' recommendations aren't completely set in stone, either. All plans and strategies allow for some revised management recommendations based on changing conditions or information, known as “adaptive management.” ■





CULTURAL CLASH

Growing recreational use challenges Lewis and Clark and Indian history preservation and interpretation at Travelers' Rest State Park. **By Susie Wall**

Maci MacPherson still winces when she thinks of how terrible the collision could have been. The near miss occurred in April 2021, while the Travelers' Rest State Park manager was repairing an outdoor exhibit. She noticed a group of senior visitors stopping along a paved trail to read interpretive signs. Then she saw, on a hilltop above the trail, a group of local boys on bicycles begin their descent. Despite MacPherson's loud warning, the boys bombed down anyway, narrowly missing the older visitors.

This potentially dangerous encounter

Susie Wall is a writer in Missoula.

exemplifies the challenges that MacPherson, her staff, and park volunteers face each year: how to protect and interpret a National Historic Landmark while managing the park's growing recreational use. "We're trying to educate these new visitors about not harming the park's historical and cultural resources and also about valuing those resources," MacPherson says.

CULTURAL CROSSROADS

Travelers' Rest, on a clear mountain stream near U.S. Highway 12, a few miles west of Lolo and 15 miles south of Missoula, was established as a National Historic Landmark in 1960 and a Montana state park in 2001.

The 65-acre site contains a visitor center and museum with Corps of Discovery and American Indian culture exhibits, picnic tables and shelters, a half-mile paved trail that encircles the Lewis and Clark Expedition's historic campsite, and two gravel trails to Lolo Creek and the Bitterroot Trail along nearby U.S. Highway 93.

The scenic spot has long attracted travelers. The site is a trail junction within the expansive aboriginal lands occupied by the Salish, Pend d'Oreille, and Nez Perce peoples, who moved through here following seasonal food sources, from bison to camas roots. Many traditional place names in the Bitterroot Valley are among the oldest words

in the Salish language. The spot where Lolo Creek flows into the Bitterroot River is called *Tmsmti*, translated as “No Salmon.”

All Montana state parks emphasize understanding and respecting the land’s significance to indigenous people. MacPherson and her staff have built a close relationship with the Salish-Pend d’Oreille Culture Committee. The park’s visitor center contains exhibits on the area’s long Indian history, and MacPherson ensures that Native American culture is the focus of many educational programs for visitors and local school kids.

Travelers’ Rest is also an extremely important stop for history buffs following the route of the Lewis and Clark Expedition. Members of the expedition, led by Shoshone guide Toby, arrived here on September 9, 1805, exhausted from their trip over snowy Lost Trail Pass. They made camp near Lolo Creek, on a spot Meriwether Lewis dubbed “Travellers Rest.”

“It’s the only place along the entire Corps of Discovery route where visitors can say with certainty that they are walking in the footsteps of Lewis and Clark,” MacPherson says.

During their stay, Lewis and Clark were visited by Salish who told them of the stream’s “No Salmon” name. It was a momentous meeting. The explorers had wondered whether continuing north (downstream) on the Bitterroot would eventually lead them to the Columbia River and then the Pacific. But the lack of salmon in Lolo Creek meant none in the Bitterroot, which Lewis correctly reasoned was caused by a waterfall somewhere downstream blocking upstream migrations of the ocean-running species. With the long delay

“It’s the only place along the entire Corps of Discovery route where visitors can say with certainty that they are walking in the footsteps of Lewis and Clark.”

caused by the Great Falls of the Missouri still fresh in their minds, the expedition leaders decided on a different route.

Based on Toby’s recommendation and their knowledge that the Pacific Ocean lay to the west, the expedition left Travelers’ Rest on September 11 and headed over the rugged Bitterroot Mountains for a near-fatal, 11-day crossing. Remembering the site as a good place to camp, they returned to Travelers’ Rest on their journey back east in 1806 from June 30 to July 3.

For years, historians estimated that the campsite was approximately 1.5 miles from the current site. After Greg E. Moulton published the 13-volume *The Journals of the Lewis and Clark Expedition* in the 1980s, historians and archaeologists began to reexamine the location based on the explorers’ maps and written descriptions in the journals. Missoula archaeologist Daniel S. Hall led an extensive survey starting in the late 1990s to determine the true location. He and colleagues uncovered fire-cracked rock that indicated the campsite’s hearth, and lead used to repair and manufacture firearms.

Even more conclusive was discovery of mercury-laced soil in what was determined to be the expedition’s latrine. In his journal, Lewis noted that Corps members commonly used Dr. Benjamin Rush’s Bilious Pills for a range of ailments. Dubbed “Rush’s Thunderbolts,” the mercury-rich

medication caused an unfortunate side effect of instant diarrhea.

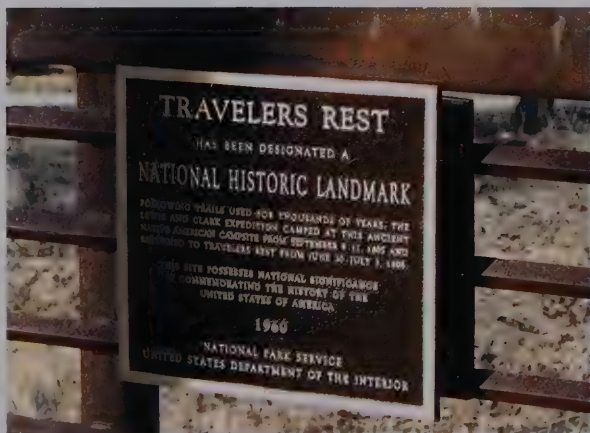
These and other findings led researchers to the campsite’s true location. Travelers’ Rest remains the only archaeologically verified Lewis and Clark campsite along the expedition’s entire route from St. Louis to the Pacific and back.

BEAUTIFUL PLACE TO PLAY

The stream, vistas, wildlife, and open forests that made the site such an appealing place to camp throughout history make it a wonderful recreation destination today. Visitors fish and swim in Lolo Creek on summer days, walk their dogs or ride bikes on the well-maintained paths, and search for some of the 138 bird species recorded within the park boundaries.

Just a few minutes from Lolo and only a half-hour drive from downtown Missoula, the park’s recreational use has skyrocketed over the past decade. When the coronavirus began sending even more people outdoors, visitation increased by 50 percent over two years, from 2019 to 2021. Some came to see the famous Lewis and Clark campground, but most were there to recreate in beautiful, natural surroundings.

Travelers’ Rest is used by Missoulians, vacationers making a quick detour off U.S. Highways 12 or 93, and Lolo residents, whose town lacks a city park. “Many resi-



MIXED USE Above left: A marker indicates the park’s National Historic Landmark status. Above right: A family visits Lolo Creek. Growing recreational use from nearby communities puts pressure on historical sites and threatens to overwhelm the park’s original preservation and interpretation mission.



NO MOTORS ALLOWED Cyclists ride past the meadow where Captains Meriwether Lewis and William Clark and their men camped next to Lolo Creek, one of the most significant sites of the Corps of Discovery expedition. Park manager Maci MacPherson says she has seen tracks of after-hours ATV and motorcycle riders running across the historic location. “I think they see it as just this big open space,” she says.

dents there have adopted this state park as a place to fill that void,” MacPherson says.

The park manager welcomes the new visitors. “Part of our mission as a state park is to promote outdoor activities and their associated physical and mental health benefits,” MacPherson says.

But she’s concerned that many newcomers don’t recognize the park’s other mission: to protect and interpret historical and cultural landmarks. She, her staff, and the park’s many volunteers worry that people who venture off trails could disturb or damage significant sites. Or that unleashed dogs

could dig up historically or culturally important areas. “There’s only been one archaeological survey here, so we don’t know what else of significance is at the park,” says MacPherson. “We have a responsibility to ensure that anything that’s undiscovered is kept from being disturbed or stolen.”

In recent years, MacPherson has seen tire tracks of ATVs and motorcycles crossing the Lewis and Clark campsite. “I think they see it as just this big open space,” she says.

Another concern is the safety of older visitors, often there to learn about the park’s history, who could get knocked down by the growing number of cyclists, joggers, and enthusiastic dogs. “I’m not saying it’s a huge issue at this point, but I have seen it almost happen,” MacPherson says.

Travelers’ Rest isn’t the only state park where growing recreational use threatens historical preservation. “Recently we’ve had visitors carve their names into historical structures at Elkhorn, create erosion on archaeological deposits at Madison Buffalo Jump, and loot a bison skeleton from Makoshika,” says Rachel Reckon, who manages FWP’s Heritage Resource Program. “It’s definitely a growing concern across our state park system.”

KEEPING THINGS SAFE

The Travelers’ Rest parking lot gate shuts at 6 p.m., but there’s no way to close off the entire park. People regularly enter after hours to swim in the creek or run the trails when no staff or volunteers are there to monitor use.

“We have a responsibility to ensure that anything that’s undiscovered is kept from being disturbed or stolen.”

As in most Montana state parks, Travelers’ Rest lacks adequate paid staff to enforce rules: no unleashed pets, no motorized use of trails, and no off-trail walking or cycling. “For the most part, people follow the rules,” says Loren Flynn, FWP regional state parks manager in Missoula. “But there’s always a few who don’t. And with increased visitation, that number is growing.”

MacPherson, who also manages two other state parks in the Bitterroot Valley, is helped by an FWP park ranger and visitor center assistant. To manage the thousands



DIGGING DOGS Another concern: off-leash pets disturbing historical sites.

of visitors who arrive each week during the summer, she also relies on a legion of volunteers. Each weekend volunteers roam the park, greeting visitors and offering gentle reminders to follow rules. “All some people need is to be asked to slow down on their bikes or put their dog on a leash,” says Flynn. He says the park could add more signs warning people to stay on trails and follow other rules, “but they don’t have the same effect as someone giving the message in person.”

That thinking is behind the Bark Ranger Program, devised by the park’s two AmeriCorps volunteers. Patrolling volunteers bring their own dogs—on a leash, of course—which provides opportunities to more easily talk to

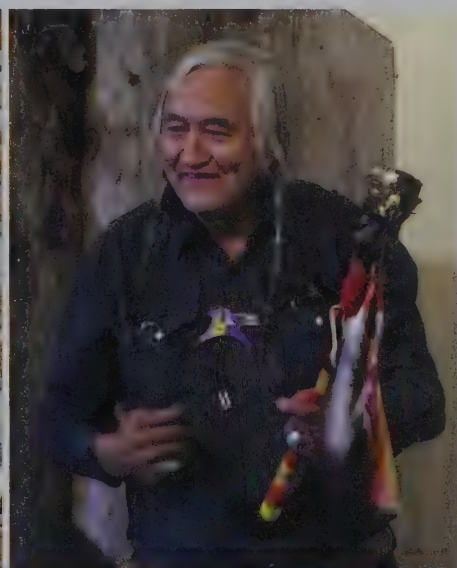
visitors with their own dogs about the importance of keeping all pets leashed.

Travelers’ Rest State Park is fortunate to receive support from Travelers’ Rest Connection (TRC), a “friends of” group that provides much-needed funding and volunteers and hosts public educational programs. Molly Stockdale, executive director, says most visitors using the park for recreation are from Lolo. She hopes to change that from a challenge to an opportunity.

“If you can foster pride in what they see as their community park, then they may want to protect it and set good examples for others,” she says. One example was TRC’s invitation for local families to paint benches in the outdoor classroom with images related

to the park, from native plant life to William Clark’s dog, Seaman. “The idea is that a kid who has spent time beautifying the park is a lot less likely to damage it later,” says Stockdale. “It’s all about pride, ownership, and stewardship.”

Nurturing stewardship, MacPherson adds, is the park’s ultimate goal. “What we’re trying to figure out now is the best way to engage all these new visitors—not just to protect the park but even more to help people understand why this place is so significant,” she says. “If they then take that insight back to their friends and family, I think we can grow support and stewardship for Travelers’ Rest beyond what we ever imagined.” 🐾



PARK OF MANY USES Clockwise from top left: Dog walking; a Salish elder giving a talk on local Native culture; teaching a family about Native tools and lodgings in the visitor center; walking across Lolo Creek.



ALMOST ELIMINATED Before European settlement, an estimated 100 million beavers populated North America. The species was nearly wiped out by commercial trapping between the early 18th and 20th centuries. Numbers have since rebounded slightly to roughly 10 percent of precolonial times.

PHOTO BY ALEX BADIYEV



Leave It to Beavers

Under the right conditions, these big, chisel-toothed rodents are transforming Montana's environments (mostly) for the better. BY TOM DICKSON



uch! Another branch whacks me in the face as I follow Torrey Ritter through an alder and willow thicket in the waist-deep water of Spotted Dog Creek. The FWP nongame wildlife biologist looks back and grins.

"I told you it was a jungle."

He had, but I still couldn't get my head around it. The day before, Ritter said we'd be visiting a westslope cutthroat trout stream that bisects Spotted Dog Wildlife Management Area, 20 miles northeast of Deer Lodge. I'd imagined a serpentine ribbon of water winding through an open grassy meadow. But this boggy 3-acre widening of the creek, where we are pushing our way through thick brush, is a chaotic quagmire, more swamp than stream.

"Most people have never seen a beaver dam wetland complex like this up close," Ritter says. He points to the stumps of two thumb-thick willows recently cut by beavers, then indicates where the industrious rodents wove branches into a dense, 20-foot-wide dam, creating deep water. As I watch four mallards, disturbed by our approach, flush up ahead and fly off, Ritter says, "Careful where you step. It's about 8 feet deep right there."

Though it's barely navigable by humans, I later comprehend that this mess of water and wood is a good thing—for beavers, other wildlife, people, and even trout. That perspective can take time getting used to. Like many people, I'd always considered beaver dams a problem, blocking the "natural" flow of streams. But I discovered that those gnawed tree trunks, flooded backwaters, and cheek-slapping shrubs are not only Montana's most wildlife-rich environments; they also may offer some relief to the state's perpetual water shortage caused by increasingly warmer summers and snow-deficient winters.

Not bad for a bunch of rodents once valued mainly as material for making top hats.

SAFE WATER

As we continue through the waist-deep water, Ritter points to a nearby beaver lodge, also

made with a layer of sticks and cementlike mud 2 or 3 feet thick. "A mountain lion would have a tough time getting through that," he says of one of the beaver's primary predators. Built either in the middle of a pond or into the bank, these domed structures contain a dry den above the waterline where beavers sleep, raise their young, and survive even the coldest winters, during which they do not hibernate. The big rodents leave these safe havens at night to cut down nearby trees and chew off branches to eat, use in dam and lodge construction, or store underwater as food.

Beavers build their dams because they

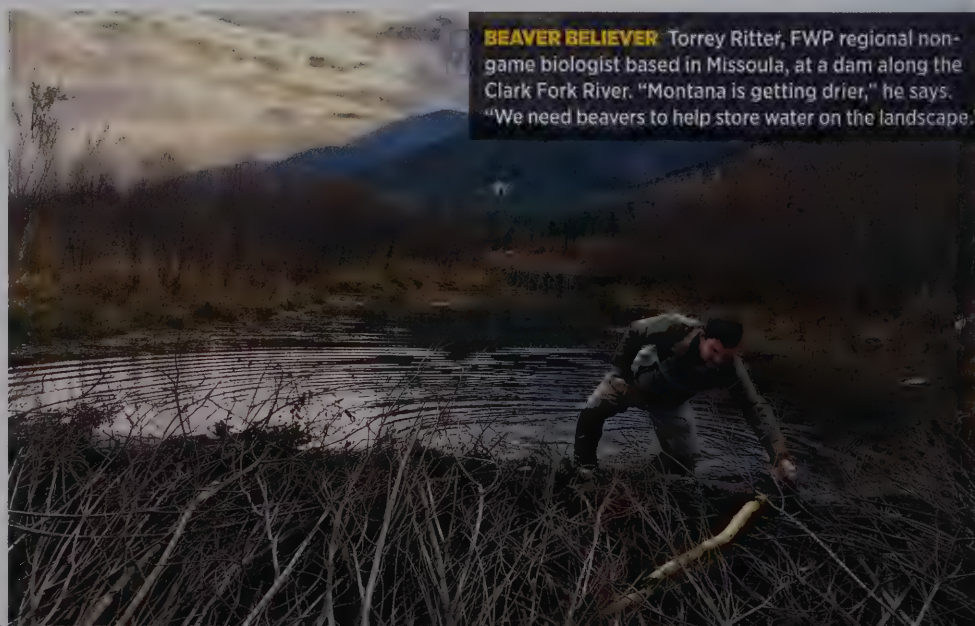
can't outrun cougars, coyotes, bears, and other predators. The slow, lumbering furbearers—about the size of a cocker spaniel—are easy pickings on land. Deep water is their salvation. The stick-and-mud dams back up streams and create pools, ponds, and canals where beavers swim safely and gain access to trees, shrubs, and other vegetation.

SO MANY BENEFITS

While building a dam, beavers set in motion a whirlwind of ecological actions. Ducking under alder branches, Ritter shows me where the stream has backed up and spread amoeba-like across the floodplain. The weight of the pond, he explains, presses water into the earth, where microbes filter out heavy metals and other pollutants. The underground water flows downstream in subterranean channels, cooling as it goes, then seeps to the surface, in many cases increasing summer flows and lowering stream temperatures.

These wooded wetlands absorb powerful floodwaters, reducing their destructive force and checking erosion. Snowmelt from surrounding mountains is captured, stored, then slowly released during the summer when downstream areas need it most. What some are now calling "Smokey the Beaver" can thwart wildfires by creating lush wet areas that slow or even extinguish flames. "Beaver wetlands also act as a type of Noah's Ark, where small mammals, frogs, birds, and other animals can escape fire," Ritter says.

The additional water above and below ground benefits ranchers, farmers, and com-



BEAVER BELIEVER Torrey Ritter, FWP regional nongame biologist based in Missoula, at a dam along the Clark Fork River. "Montana is getting drier," he says. "We need beavers to help store water on the landscape."

Tom Dickson is the Montana Outdoors editor.



STICK-AND-MUD CITADEL A beaver constructs a lodge in western Montana. A fortress of sticks and mud, the structures have a dry chamber inside above the water line. Accessible only by underwater tunnels, lodges allow beavers to sleep and raise their young safe from predators.

munities in other ways. For instance, just north of the Montana-Alberta border, the city of Lethbridge is using beaver activity to increase water supplies during drought. And in Idaho, ranchers like Jay Wilde are partnering with state and federal wildlife biologists to “re-beaver” creeks and hold back more water for livestock. “When you see the results, it’s almost like magic,” Wilde told *Beef* magazine.

Not surprisingly, all that extra water and vegetation is a boon to fish and wildlife. Species that share beaver-made wetlands include moose, deer, otters, mink, muskrats, great blue herons, cavity nesters like woodpeckers and wood ducks, fishing birds such as ospreys and kingfishers, bats, waterfowl, frogs—even sage-grouse, which lead their chicks in summer to green meadows surrounding beaver ponds to find insects.

Fish benefit from increased streamflows and oxygenated upwellings of cold water below beaver dams. Deep beaver ponds, which don’t freeze solid, provide winter refuge. They also trap sediment that otherwise would wash downstream and cover spawning gravel. According to David Schmetterling, head of FWP’s fisheries research unit, when snowmelt on steep rivers like the North Fork of the Blackfoot gushes downstream

each spring, it scours the streambed. “We’re finding that beaver dams there actually prevent spawning gravel used by bull trout and westslope cutthroat trout from washing away,” he says.

A FASHION CASUALTY

The modern beaver (*Castor canadensis*) arrived in North America from Eurasia via the Bering Strait roughly 7 to 8 million years ago. Before European settlement, an estimated 100 million beavers populated a range covering most of the continent—from what is now Alaska and Canada south to northern Mexico. For thousands of years, indigenous people ate the rodents’ flesh and fatty tails and made tanned pelts into warm clothing.

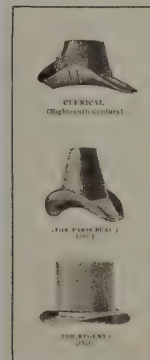
Then came the top hat. Just as the craze for ladies’ feathered hats in London and Paris led to the near-extinction of North America’s egrets in the late 1800s, the mania for men’s beaver-felt headwear, which began in the early 17th century, nearly wiped out beavers. By 1930, it’s

estimated that only about 100,000 of the animals had escaped commercial trapping, mostly in remote Canada. Subsequent trapping bans and low fur prices—a pelt today fetches just one-tenth the price in 1890, adjusted for inflation—have resulted in continental populations rebounding to 5 to 15 percent of historic numbers.

THERE GOES THE WATER

The widespread loss of beavers and their dams made much of North America drier. Snowmelt and rain previously stored in ponds, wetlands, and underground aquifers now rushed downstream to the ocean. In mid-summer, wetlands and meadows became parched while water levels in tributaries dropped, leaving little for spawning fish.

At the Spotted Dog swamp, Ritter says that beavers historically created a similar wetland complex but on a far grander scale. He points to decades-old gnawed sticks jutting out from a deep-cut bank. Beavers were removed in the mid-20th century, probably to keep the meadow from flooding. Without dams to slow its flow, Spotted Dog raced downstream “like an irrigation ditch, gushing like a fire hose,” Ritter says. Instead of naturally overflowing its



The Complex, Chaotic World of a Beaver Dam Wetland

1 It all begins when beavers hear moving water and start backing it up to form a deep pool. Here they can live safely from predators like mountain lions, bears, wolves, and coyotes. The large rodents first construct a low ridge of rocks, sticks, and mud across the stream channel. Over that they add more sticks and mud, building the structure higher.

2 Additional mud is added to the entire face of the dam to seal the structure.

3 Dams can block upstream and downstream fish passage, especially for bull trout. The large salmonids move upstream to spawn in late summer, when water levels are especially low.

4 Beavers and salmonids co-evolved over millions of years. Fish like westslope cutthroat trout often—though not always—find slots in dams where they can make their way upstream.

5 Some dams are only several feet long, while others extend for hundreds or even thousands of feet. One especially massive beaver wetland complex in Alberta, visible from space, is inundated by a dam stretching a half-mile long.

6 The backed-up water spreads sideways across the floodplain, filling meadows with water and nutrient-rich silt that invigorates plant growth. Moose are among the dozens of wildlife species that use these shallow wetlands.

7 Trees toppled into the water provide resting places for turtles, birds, and other species.

8 Bats and other insect eaters visit beaver-made wetlands to feed on moths, mosquitoes, caddis flies, and mayflies. **9** Kingfishers and other piscivores hunt for minnows and other fish.

10 Beavers build their dams by toppling nearby trees into the water using their chisel-sharp front teeth.

11 They then gnaw off branches, which they eat on the spot, use for building material, or carry back to the lodge to store for later consumption, like keeping food in a pantry.

12 After cottonwoods and willows are cut down, the trees and shrubs resprout, creating new growth.

13 Among their many benefits, beaver-made wetlands serve as firebreaks that slow or even stop wildfires from spreading and as refuges for fleeing wildlife.

14 As the wetland complex raises the water table, surrounding meadows become green and lush, attracting grazers such as elk.

15 Flooded trees die and create snags for cavity nesters like woodpeckers and wood ducks. They also provide perches for ospreys and other raptors.

16 Most shrubs in a beaver dam wetland are alders and willows.

17 Waterfowl thrive in this watery world.

18 So do great blue herons and other wading birds.

19 Beaver dam wetlands trap snowmelt, holding it for months so it can dribble out in small doses, cooling waters downstream during the hot summer.

20 Small side ponds along wetlands are homes for frogs and toads. The warmed shallow water provides ideal conditions for the amphibians' life cycle.

21 Beavers build their domed lodges in the pond or along a bank. The structures are hollow inside with areas above the water line where beavers sleep and raise their young. **22** Access is through underwater tunnels inaccessible by land predators.

23 Most predators, including lions, cannot dig through the thick lodge, allowing beavers to remain safe.

24 The weight of a beaver pond presses water down into the ground. **25** Microbes in the soil filter contaminants, purifying the water. As the water flows underground, it cools.

26 Downstream, the cold, clean water percolates up to the surface. There it oxygenates fish eggs, cools trout streams, and provides additional water for irrigation and community drinking supplies. **27** Deep water in ponds provides warmer wintering areas for fish.

28 As beaver ponds slow streamflow, sediment in the water settles to the bottom. Though they can increase silt upstream, the dams prevent silt from washing downstream and covering fish spawning areas and suffocating underwater insects living in gravel areas. ■



WATER DOESN'T BURN Above: Researchers across the West are finding that beaver dam complexes can slow or even halt wildfires. Shown here is a beaver dam wetland oasis in the center of the Sharps Fire, which burned 65,000 acres of central Idaho in 2018. Wetland complexes like these are set in motion as soon as beavers begin blocking a stream channel with their dams (below), backing up water and sending it out across the floodplain.

TOP TO BOTTOM: JOE WHEAT/UTAH STATE UNIVERSITY; SHUTTERSTOCK



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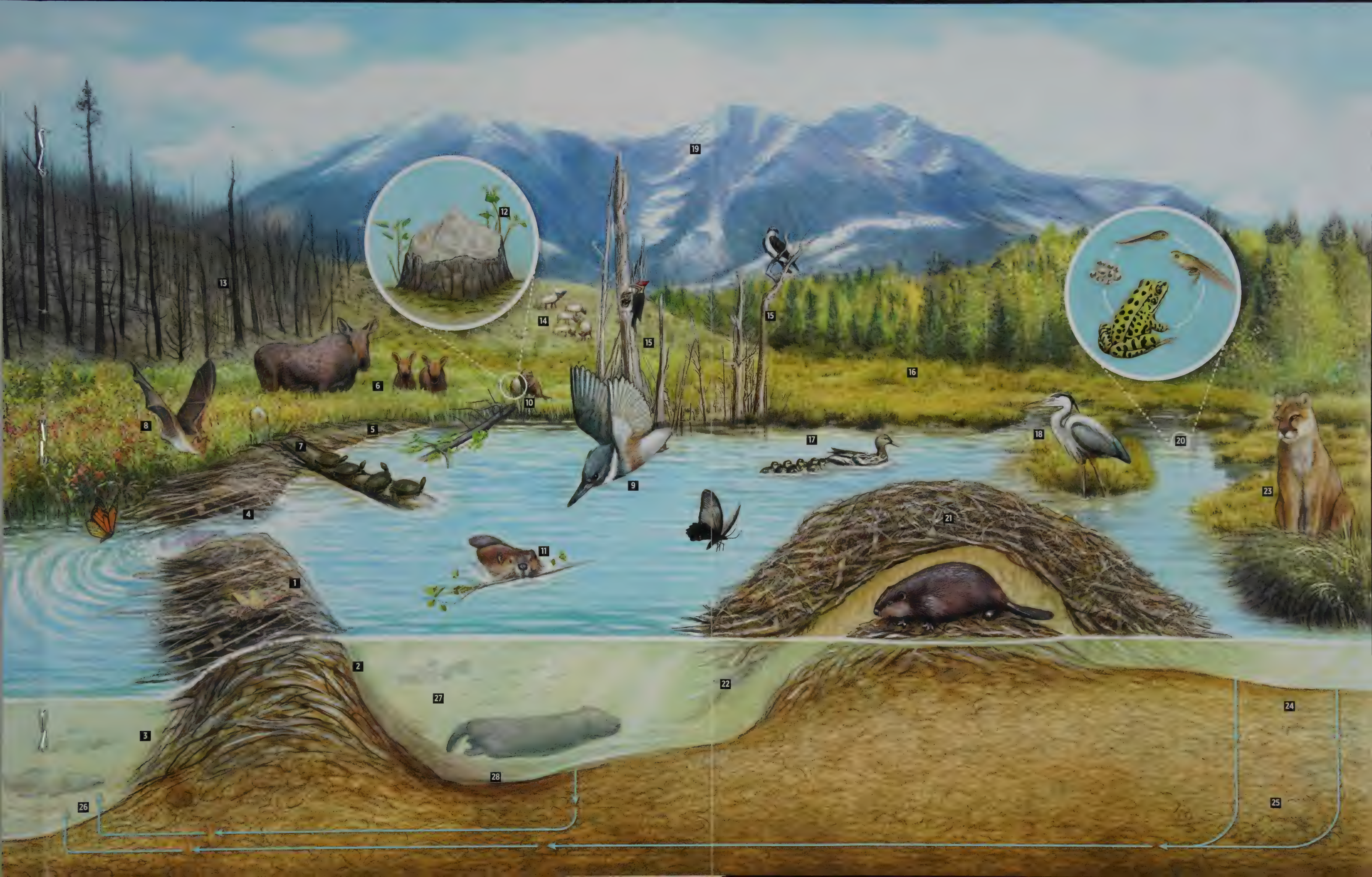
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banks and spreading water across the floodplain during spring runoff, the stream carved down ever deeper until hitting bedrock, its banks dropping 4 feet or more. "Then, whenever beavers tried to build a dam across that channel, it got blown out each spring," Ritter says. Meanwhile the surrounding valley floor, cut off from the stream, dried up, and with that water went ecological benefits that beavers had created for thousands of years.

PROBLEMS AND SOLUTIONS

Despite all the good they do, beavers definitely can cause problems. They plug irrigation ditches, headgates, culverts, and any other place where moving water triggers their damming impulse. Dams flood roads, cattle pastures, golf courses, and more. The industrious rodents also gnaw down shade trees, like the stately cottonwoods toppled a few years ago along the Flathead River at Old Steel Bridge Fishing Access Site a few miles east of Kalispell.

The two biggest concerns for fisheries managers are siltation and movement barriers, especially for bull trout, Arctic grayling, and westslope cutthroat trout—three at-risk species now at a fraction of historic population levels. Though beaver dams prevent sediment from washing downstream, they can also cause it to accumulate upstream in backed-up water. Dams have covered spawning gravel with silt in slow-flowing tributaries of the Big Hole, Madison, Jefferson, and Yellowstone rivers.

Dams can also prevent salmonids from swimming upstream to spawning waters. In Red Rock Lakes National Wildlife Refuge, one of the last holdouts of Arctic grayling in the Lower 48, beaver dams have both silted spawning areas and blocked spring migration.

Yet beavers and salmonids co-evolved for millions of years. Before European settlement, the West was awash in beavers and coldwater fish species. Why are the industrious rodents considered a threat today?

Historically, if a beaver dam blocked or silted in one spawning tributary, salmonids could still reproduce in countless others. Not anymore. Habitat loss and warming temperatures have shrunk Montana's bull trout population to a small percentage of former numbers. Grayling loss is even greater.



PROBLEMS Above: Water from beaver dams can flood and even wash out roads. Below: The structures can also block bull trout and Arctic grayling seasonal movements and increase siltation upstream that can smother spawning gravel.



FLOODING SOLUTION Below: Pond-leveling devices like this can lower water levels without having to remove beavers and destroy their dams, which incoming beavers can quickly rebuild in a few days.



Beavers aren't bad for trout and grayling everywhere, just in certain critical streams. Though FWP fisheries crews still remove some beaver dams, "studies in Montana are showing more and more that the benefits to trout and grayling usually far outweigh the detriments," Schmetterling says.

Solutions to other beaver problems include galvanized welded wire fencing to protect vulnerable riverside trees, and other fencing to keep beavers away from irrigation ditches and headgates. To lower water levels

on flooded fields and roads, crews use "pond levelers" made of a flexible, large-diameter PVC pipe punched through the dam with a wire-fenced intake at the inlet. "Basically, it creates a permanent leak in a dam that beavers can't plug," says Elissa Chott of the Clark Fork Coalition, who helps resolve beaver conflicts.

Since starting with the coalition in 2018, Chott has trained hundreds of landowners, road and railway maintenance crews, and public agency staff to install and use pond levelers as well as tree and culvert fences. Funding for cost-sharing and technical assistance comes from the National Wildlife Federation, Defenders of Wildlife, FWP, and counties.

As she's helping ranchers and others solve beaver conflicts, Chott touts the animals' enormous value. "We want to get people to think about them in a different way, not as a pest that needs to be removed but as an animal we can coexist with and reap their benefits, like more wildlife habitat and groundwater storage," she says.

BRINGING BACK THE BEAVERS

Expanding those benefits across Montana often requires repairing "incised" streams like Spotted Dog. "It doesn't take much," Ritter says, pointing to a sofa-size pile of rocks and logs that crews placed in the creek in 2020. The plug immediately backed up water that spread sideways across the shallow valley and attracted beavers from colonies downstream. The newcomers added more dams, dug channels, and built lodges. "The idea is to get streams back to a state where beavers can be successful," Ritter says. "Then they take over the restoration work."

Another way to make areas more inviting to beavers is adding rocks and logs within a deep-cut channel bed. This raises a stream so that spring rains and snowmelt once again breach the banks. "There are different ways to connect a stream with the floodplain, which is the goal," Ritter says. "It just depends on the particular stream."

FWP and conservation groups are looking for more streams where improvements could encourage beavers to move in. Trapping beavers from one area and moving them to potential sites can work, but only under ideal conditions. "If the habitat isn't



UNDERWATER WONDER Though slow and clumsy on land, beavers are swift, agile swimmers. The rodents are aided by powerful webbed feet; a broad, rudderlike tail; transparent eyelids; and an extra set of lips behind their teeth so they can chew and carry branches beneath the surface without drowning. A challenge for FWP biologists and land managers is returning these marvelous mammals to areas where they do more good than harm.

good, translocated beavers just leave,” says Ritter. “And if conditions are favorable, either they are there already or will eventually move in on their own.”

To find areas where natural beaver recolonization would succeed, Ritter and other wildlife biologists use what’s known as the Beaver Restoration Assessment Tool (BRAT).

Developed at Utah State University and managed here by the Montana Natural Heritage Program, BRAT is a computer mapping program that predicts where beavers could most easily build sustainable dams without disrupting roads, bridges, irrigation canals, and other development. “You can’t put beavers just anywhere. The conditions have to be

just right,” says Schmetterling. Later that day as Ritter and I drive away from Spotted Dog, he pulls over so we can look down at the stream. From this vantage point it’s easy to see where the initial human-made plug caused the creek to balloon like a watery python with a deer in its belly, creating a green oasis within the parched hills. With night approaching, the mallards we flushed earlier circle overhead before dropping down to the beaver pond.

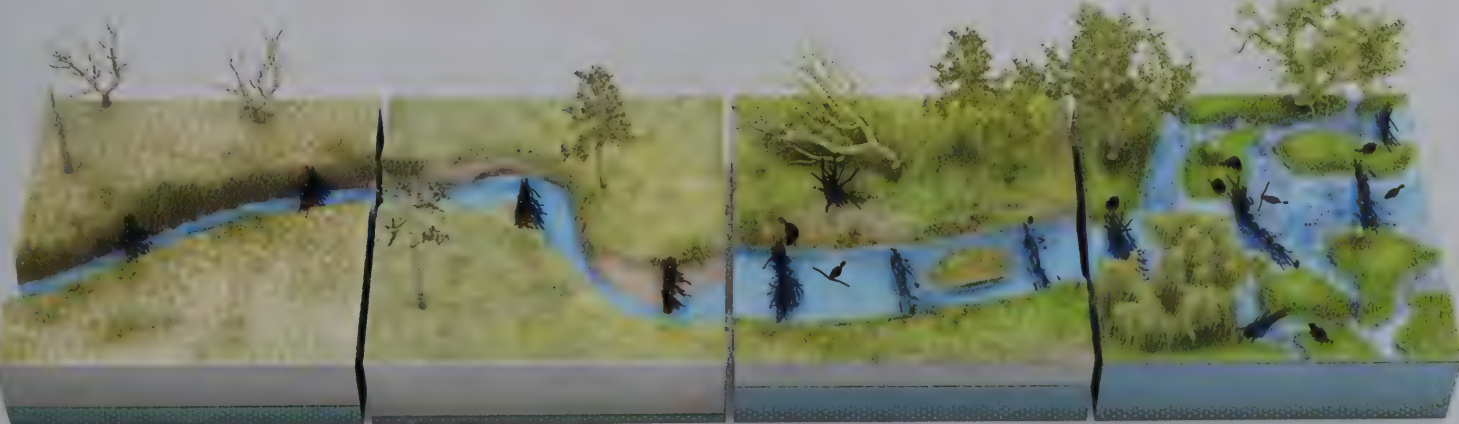
In a West plagued by wildfires and drought, it makes sense to create more wetland complexes like this one—though not where they give ranchers and fisheries biologists heartburn. Obviously, beavers can’t bring more rain or ease summer droughts. But by keeping more water on the landscape and underground, they can help. “They just need a nudge in the right direction,” Ritter says. 🐿

Watch a video of crews building a beaver habitat structure on Spotted Dog Creek.



A stream comes back to life

Across the West, scientists and land managers are using artificial beaver structures to heal damaged streams, reestablish beaver populations, and increase water storage. In some cases, researchers have seen positive changes in just a few years.



Adding dams

Beaver trapping and overgrazing have caused many creeks to cut deep trenches, causing water tables to drop and dry up floodplains. Installing channel-blocking structures can help.

Widening the trench

The structures divert flows, causing streams to cut into banks, widening the incised channel and creating a supply of sediment that helps raise the streambed.

Beavers return

As the structures trap sediment, the streambed rebuilds and forces water onto the floodplain, recharging groundwater. The deep water attracts beavers, which then recolonize.

A complex haven

Reestablished beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife and groundwater recharge.

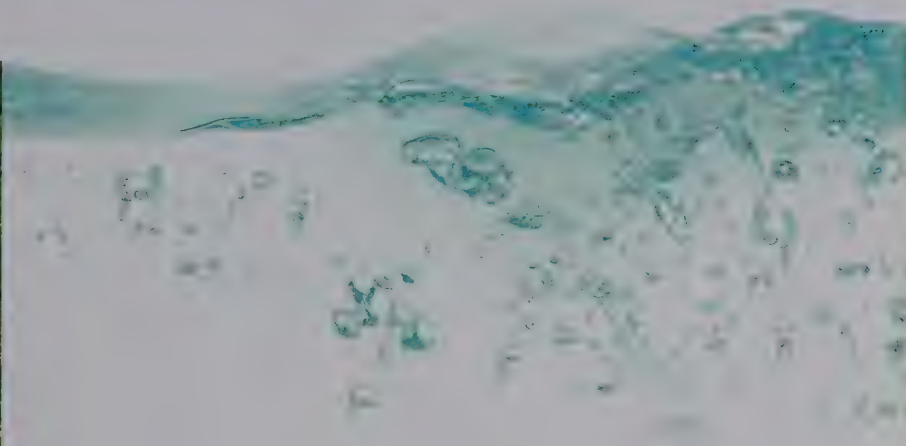
TROUT STREAMS



SWIMMING IN AIR Rainbow trout rest beneath a bed of watercress on a small limestone spring creek in central Montana. The clear water and abundant vegetation are typical of these trout-rich streams.

PHOTO BY KENTON ROWE

ON STEROIDS



Formed by ancient crustacean and mollusk fossils, limestone produces some of Montana's most productive trout waters.

By Jeff Erickson

As we followed the streamside trail, my wife Mary and I marveled at the cold, crystalline water racing downstream from one of the nation's largest freshwater limestone springs. The meandering stream was a trout paradise: extensive undercut banks, waist-deep runs, and underwater holes big enough to hide a moose, with a bottom covered in luxuriant, waving fronds of aquatic vegetation, and banks anchored by thick stands of willows and tall grass.

Fly rods in hand, we were just south of Lewistown exploring the Brewery Flats stretch of Big Spring Creek, an area restored in the early 2000s after decades of industrial use and now a premier trout stream.

Big Spring, one of Montana's most productive spring-fed trout creeks, exemplifies how limestone mixed with sufficient groundwater can create exceptional trout habitat, populations, and fishing. Precipitation in the nearby Big Snowy Mountains infiltrates the uplifted limestone and gushes to the surface at a consistent 50,000 to 64,000 gallons per minute, chilled to a trout-friendly 52 degrees and rich with calcium carbonate that supercharges production of the mayflies, caddis flies, and other aquatic insects that trout eat. "Steady and abundant flows, cold water temperature, and just the right water chemistry—Big Spring Creek has it all," says Don Skaar, a recently retired FWP senior fisheries manager who worked on the stream for more than 30 years.

RIVERS THAT RUN THROUGH LIMESTONE

Montana is known mainly for its many “free-stone” rivers like the Bitterroot, Blackfoot, Gallatin, Stillwater, and Yellowstone. These rivers depend on rain and summer snowmelt from surrounding mountains, where most of them originate. Their flows and temperatures fluctuate widely throughout the year, ranging from icy mountain runoff in late spring to tepid trickles in late summer. Underwater invertebrates, including large stoneflies, live among the stone-filled streambeds.

Far less abundant are Montana’s limestone spring creeks, waters more commonly associated with Pennsylvania or the Midwest’s Driftless Region, which encompasses parts of Wisconsin, Minnesota, and Iowa. Though harder to locate in Montana, I find these streams particularly appealing, not only for their big and abundant trout, but as places where geology, chemistry, and biology

combine beneath the earth’s surface to fuel abundant plant and animal life above, often amid parched, desertlike surroundings.

To find these productive trout waters, I regularly consult my Geologic Map of Montana. Poring over this massive cartographic masterpiece, which covers our dining room table, I look for areas of porous limestone through which aquifers flow, bubbling up as cold, fertile trout water.

Most common is Madison limestone. This vast geologic formation stretches from the Black Hills of South Dakota to eastern Idaho, and includes the Big Belt, Little Belt, Big Snowy, and Little Snowy mountains of central Montana. These ranges in turn feed trout waters like the Smith, Judith, and upper Musselshell rivers, along with Belt, Sixteen-mile, and Big Spring creeks. Also containing Madison limestone are the Bighorn and Pryor mountains south of Billings, through

which flow Sage and Crooked creeks. To the west, the Boulder River cuts through a limestone band wrapping around the largely volcanic Absaroka Range and flows north into the Yellowstone at Big Timber.

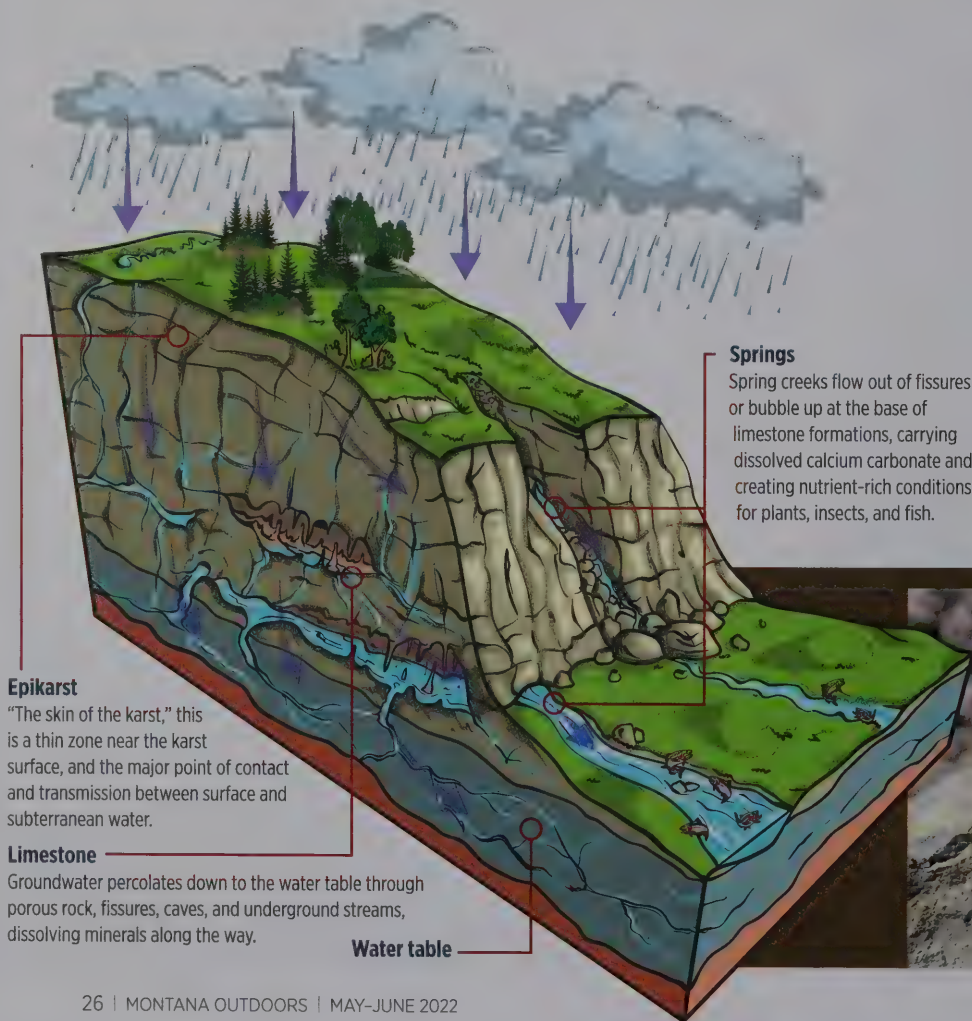
Limestone deposits also exist in southwestern Montana, including layers in the Blacktail, Snowcrest, Beaverhead, and Tendency ranges, whose aquifers contribute water to streams like Big Sheep and Blacktail Deer creeks and the Beaverhead and upper Ruby rivers.

Montana’s most famous spring creeks are three privately managed pay-to-fish waters in the Paradise Valley south of Livingston: Nelson’s, DePuy, and Armstrong, the latter described as “one of the world’s richest little trout streams, in both insect life and trout population” by author Tom Rosenbauer in *The Orvis Guide to Prospecting for Trout*.

THE CRUSTACEAN CONNECTION

Between 65 and 600 million years ago, during the Paleozoic and Mesozoic eras, sedimentary sheets of limestone, dolomite, shale, and sandstone were deposited across much of what is today Montana, Wyoming, and Idaho. The region was also covered by shallow, warmwater seas, teeming with primitive crustaceans and mollusks that extracted calcite from the water to form hard, protective shells. As sea levels rose and fell over eons, thick layers of trillions upon trillions of these tiny sea creatures collected on the bottom, eventually solidifying with dead vegetation and silt into limestone rock.

Limestone is named for its ability to pro-



Springs

Spring creeks flow out of fissures or bubble up at the base of limestone formations, carrying dissolved calcium carbonate and creating nutrient-rich conditions for plants, insects, and fish.

Epikarst

“The skin of the karst,” this is a thin zone near the karst surface, and the major point of contact and transmission between surface and subterranean water.

Limestone

Groundwater percolates down to the water table through porous rock, fissures, caves, and underground streams, dissolving minerals along the way.

Water table

FOSSIL FERTILIZER Below: Clam fossils in limestone indicate the connection between ancient sea creatures and the nutrient-rich waters that flow through these geological formations.



duce quicklime (calcium oxide) when subjected to high heat. Quicklime is used in a wide range of industrial applications, including water purification, glass manufacturing, and building construction.

In nature, limestone is readily dissolved by the natural acidity of rain and groundwater, creating Swiss cheese-like fissures through which water flows. The water becomes rich in calcium carbonate, which

Just because an area contains limestone doesn't mean productive trout streams are flowing down the hillsides.

acts like fertilizer for aquatic plants, insects, and crustaceans such as scuds and crayfish. "Even though limestone is rock, it feeds things and functions as building blocks for life," says David Schmetterling, FWP fisheries research coordinator.

One of the most important things limestone feeds is trout. Streams rich in calcium carbonate produce more trout than those without the chemical compound. They also grow lots of big trout. Describing Armstrong Creek, Rosenbauer writes, "You can wade across its transparent riffles and barely get your ankles wet, yet every day of the year a trout over 20 inches is a possibility."

ABSORPTION AND REFRIGERATION

In addition to influencing water chemistry, limestone has beneficial, moderating effects on streamflows and temperatures. The porous, fractured rock acts as an enormous sponge, absorbing precipitation then releasing it in steady, trout-friendly increments. Similar to the tailwaters below dams, streams fed by limestone aquifers are less likely to whiplash between extreme floods and drought-stricken trickles.

Limestone springs also cool streams during summer heat and warm them in midwinter. Trout require chilly water because it holds the high levels of dissolved oxygen they need to survive. When a stream's water temperature exceeds 70



CLEAR AND COLD Belt Creek, which cuts through Sluice Boxes State Park southeast of Great Falls, flows out of the Madison limestone formation. Like other limestone-influenced streams, the water is clear, cold, and fertile, creating ideal conditions for trout.

degrees, trout begin to die outright or are far more likely to perish from the stress of being caught by anglers.

But the water can't be too cold. Once temperatures drop below 45 degrees, trout become dormant to conserve calories. They feed a bit, but not much. Many freestone streams freeze over and even produce "anchor ice" along the bottom, creating inhospitable conditions for trout and the aquatic insects they eat. Limestone-fed

springs help keep temperatures in the sweet zone of 55 to 60 degrees year round, allowing trout to feed throughout the winter and grow larger than those in nearby freestone waters.

LIMESTONE PLUS WATER

Just because an area contains limestone—and Montana is packed with it—doesn't mean productive trout streams are flowing down the hillsides. It needs water, too. Cracks, fissures, caves, and sinkholes in the limestone

Jeff Erickson is a writer in Helena.

formations—typical of what’s known as “karst” topography—allow subterranean water to move through the calcium-rich stone to the surface. “I can’t overemphasize the importance of faults for providing springs,” says Dr. Rob Thomas, a professor of geology at the University of Montana-Western.

But even the winning combination of limestone and underground springs doesn’t always guarantee great trout water. For instance, Florida has enormous limestone-fed springs, but the warm water temperature is more conducive to growing largemouth bass than salmonids.

Another factor is the degree to which a stream receives underground water. In true spring creeks, most flow comes from underground rather than rain and snowmelt. But on others, subterranean water may have less influence, or affect only certain stretches.

For instance, Belt Creek and the Smith River are rimmed with limestone walls, yet both receive much of their flow from runoff, not springs. The Boulder River has even less limestone, so the rock’s influence there is even more reduced.

Yet even a little limestone spring water

Fishing spring creeks is my way of staying close to this reminder of life’s eternal cycle.

can mean a lot for fish. “Basin-fed freestone rivers have many periods that are not favorable for trout growth,” like warm summer flows, cold winter temperatures, and high turbidity during early summer runoff, Schmetterling says. The moderating and

fertilizing effects of limestone springs help rivers like the Boulder produce more and larger trout than they could otherwise.

Beyond the science, limestone spring creeks symbolize an ageless metamorphosis and reincarnation, as if gushing from the earth’s mysterious subconscious. Fossil-filled limestone exemplifies the cycle of life, destruction, and rebirth. Like the primordial crustaceans that formed these vast stone formations, all living creatures die then become biologically resurrected into something new and beautiful—as soil, a plant, or a fat spring creek trout.

Fishing spring creeks is my way of staying close to this reminder of life’s eternal cycle in places where, as author Ted Leeson writes in *Jerusalem Creek*, “life rises somehow closer to the surface and makes itself more sharply felt.” 🐟



TROUT PARADISE VALLEY Lush stream vegetation indicates limestone-influenced streams, such as Armstrong Spring Creek southeast of Livingston. Living among the aquatic plants are insects that grow trout to remarkable sizes. Though these streams are small, trout can reach 20 inches in the fertile waters.

How to fish a spring creek

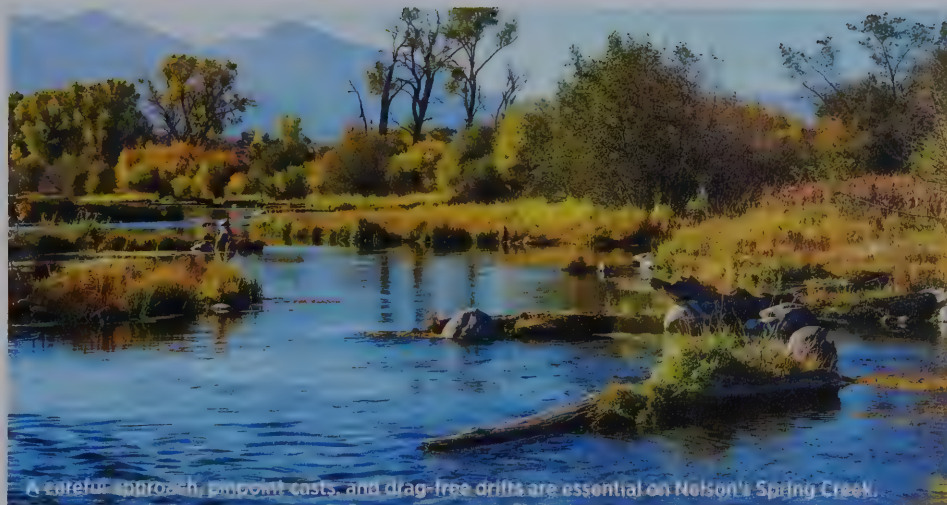


For anglers accustomed to watching their chunky caddis imitations float through rocky riffles or flinging thumb-size salmonfly imitations against willow-lined banks, fishing a spring creek can be infuriatingly difficult.

First some good news. Because spring creek temperatures and water levels are relatively stable and runoff is less of an issue, you can fish them year round. For instance, while the adjacent Yellowstone River in the Paradise Valley can be a muddy torrent when snowmelt gushes down from the surrounding Gallatin and Absaroka ranges, anglers visiting Armstrong, DePuy, and Nelson's spring creeks often find the fishing to be nearly as good as in midsummer.

And then there's the sheer number of trout, usually big trout, that spring creeks produce, with densities several times that of similar-size freestone streams.

Now the tough news. Whereas an angler on the Bitterroot or Big Hole can luck out and occasionally draw a strike with a sloppy cast, spring creeks offer no such forgiveness. The waters are virtually transparent, and the fish can easily spot you and your clumsy motions. You must go low and slow. Wear earth colors and save your bright lime-green bonefishing shirt for the bar afterward. Trout can also feel



A careful approach, pinpoint casts, and drag-free drifts are essential on Nelson's Spring Creek.

and hear you wade, so stay on the bank as much as possible. Never cast over a rising fish, because even the line's shadow can spook it. False cast to the side before sending out the main cast.

Use a small 3- to 5-weight rod. Leaders should be at least 10 feet long topped by a 2- to 3-foot tippet of 5X to hair-thin 7X.

WATCH YOUR DRIFT

As for technique, if you remember only one thing about fishing spring creeks, it's that a drag-free drift is essential. Doing that is even harder in summer, as aquatic vegetation creates complicated microcurrents that make your fly skid around the water surface. The trick is to lay out plenty of curves in your line and leader. Picky risers often require a downstream "reach" cast followed by several shakes of the rod tip to put even more line on the water as the fly drifts down to the fish ahead of the tippet.

Try to fish on overcast days—including those with light rain or snow—which often ignite a stream's most prodigious hatches.

Fly-fishing anywhere requires patience and careful observation, and that's even more true on a spring creek. There may be hatches occurring simultaneously, with different fish keying on dissimilar insects or particular life stages. Carry—and experiment with—a diverse selection of nymphs, emergers, cripples, duns, and spinners. Trout may also frustratingly shift preferences as a hatch progresses. Remain mellow, intuitive, and resolute, like a major league hitter digging in, studying the pitcher for tells about what's coming next.

TOSS TINY FLIES

The fastidious gourmands inhabiting Montana spring creeks enjoy abundant, year-round buffets. That makes them finicky about how, when, and what they eat. Frequently, their meals are tiny, no larger than size 16. Prime hatches often include Blue-Winged Olives (*Baetis*, size 18–24, March through late May, and mid-August through mid-December); Pale Morning Duns (PMDs, size 14–20, mid-June to September); Sulphurs (size 18–22, June to September); Tricos (size 18–24, late July to September); caddis (various species, size 12–22, mid-April to September); and midges (size 16–28, year round). Small ants and beetles are key during the warmer months. Meatier terrestrials like hoppers and crickets plopped bankside entice fish from late summer into early fall.

Scuds and sowbugs are money patterns anytime, as are thin Pheasant Tail nymphs (a pattern originally developed for the spring creeks of southern England). Try streamers like leech and sculpin imitations in the spring, fall, and any season on a cloudy day. ■

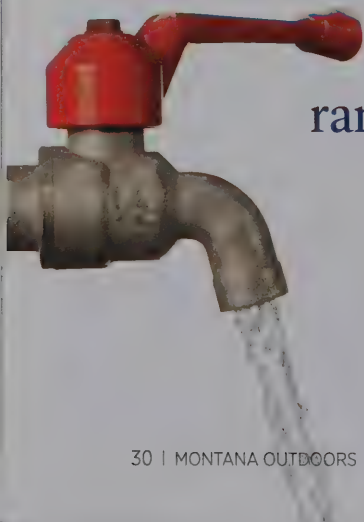
—Jeff Erickson



Searching for trout in the clear, vegetated waters of DePuy Spring Creek.



LEAVING SOME FOR THE FISH



Conservation-minded ranchers helped save trout and Arctic grayling by giving up precious water during last year's record-breaking drought. **By Peggy O'Neill**

Cal Erb looks over his stretch of Montana near Wisdom, watching clouds build over the Pioneer Mountains in the distance. It's late October 2021, and there's a hopeful chill in the air. Erb's family, which has been involved in ranching since his grandfather was a cattle trader, has owned this particular piece of land since 1988. Erb sighs as he reflects on the last several months.

"It was not a pleasant year," he says.

The drought of 2021 hit the Big Hole River ranching community hard. Though winter snowpack and precipitation in the drainage were above average early in the year, snowpack peaked on April 1—two weeks earlier



PAYS TO SAVE Below: Big Hole rancher Tom Mitchell talks to Jarrett Payne, FWP riparian ecologist, about conservation measures that kept more water in the river during the 2021 drought, benefiting beleaguered Arctic grayling (above), a species that has been petitioned for federal endangered species listing.

than usual, according to Matt Norberg, a Montana Department of Natural Resources and Conservation (DNRC) hydrologist. Then the snowpack started melting far faster than usual. By May 1, it had been reduced to 68 percent of normal.

"Precipitation during the late spring and summer months is critical to maintaining streamflows after the snowmelt has passed," Norberg says. "But June, July, August, and September were dry, dry, dry."

The National Weather Service reported that June and July were the driest period on record for the Big Hole Valley. The surrounding Beaverhead County experienced record-high temperatures. Wildfires near Wisdom and Wise River drove elk herds

down from surrounding mountains seeking what little grass was available on the parched ranchlands.

Erb says he was 700 tons of hay short for the year, which equals a loss of about \$140,000. With no pasture to graze his yearlings, he had to ship them early and about 50 pounds light, compounding the loss.

"You can't make water," he says.

THE GRAYLING AGREEMENT

You can definitely conserve it, though.

In the Big Hole Valley, Erb and many fellow ranchers kept the drought's effects from being even worse—for themselves and the Arctic grayling and trout in the river. The Big Hole water gauge nearest to Erb's prop-



erty measured the lowest flow since it was installed in 1988, the year the river near Wisdom went dry for 24 days. Yet as the



BAD, BUT NOT AS BAD Above: The Big Hole near Wisdom ran extremely low in September 2021. But thanks to conservation measures taken by landowners working with state and federal agencies, water continued to flow, saving Arctic grayling and other salmonids popular with local and out-of-state anglers. "There's now around 1,000-plus breeding adult grayling in the Big Hole, a 168 percent increase" over the past two decades, says Jarrett Payne, FWP riparian ecologist. Below: The same stretch in September 1988, when the river ran dry for 24 days during a lesser drought, before the conservation measures were in place.



landscape baked again in 2021, the river and tributary water that ranchers use for irrigation continued to flow—though not enough to grow all the hay they needed—and fish populations survived.

Erb, along with several dozen neighbors, participate in a program called the Big Hole Arctic Grayling Candidate Conservation Agreement with Assurances (CCAA). This mouthful of a federal program is helping keep ranching, grayling populations, and trout fishing alive on the Big Hole.

Under the agreement, participating landowners voluntarily carry out certain conservation measures on their properties to benefit Arctic grayling, a sail-finned salmonid species once common in the watershed but now so rare it has been petitioned for listing as federally endangered. In return,

“Had we exercised our entire water right, we could have dried up the river. Lots of sacrifices were made to keep the water flowing.”

the U.S. Fish & Wildlife Service agrees not to impose strict regulations on the landowners if the species is ever placed on the endangered species list.

So far, it looks like that designation won't happen anytime soon. In 2020, the USFWS decided not to list the species, citing water conservation and stream improvement measures gained from the CCAA as a major reason.

Many Big Hole landowners had already been using less of their legally allotted water before entering into the conservation agreement. But the Endangered Species Act looming in the distance became an added incentive for more area ranchers to follow suit.

Though the beleaguered grayling is the primary beneficiary, the deal also leaves more water in the Big Hole for hay irrigation. And it helps the river's brown, rainbow, and westslope cutthroat trout, which attract anglers who boost the local economy. “Big

Peggy O'Neill is chief of the FWP Information Bureau in Helena.

Hole trout angling is a side benefit of the CCAA that doesn't get a lot of attention but really needs to," says Eileen Ryce, head of the Montana Fish, Wildlife & Parks Fisheries Division.

Currently 32 landowners have jointly enrolled more than 160,000 acres of private land in the Big Hole CCAA, says Jarrett Payne, an FWP riparian ecologist who specializes in grayling habitat. As part of the agreement, a team from FWP, the federal Natural Resources Conservation Service (NRCS), DNRC, and USFWS works with landowners on developing fish habitat enhancement plans. Enhancements include improving streamflows, repairing stream habitat, removing or modifying barriers that block fish passage, and adding screens to reduce the number of grayling trapped in irrigation ditches.

Most important is to keep as much water in the Big Hole and its tributaries as possible. That means ranchers voluntarily don't use all the water to which their water rights entitle them. "Had we exercised our entire water right, we could have dried up the river," Erb says. "Lots of sacrifices were made to keep the water flowing."

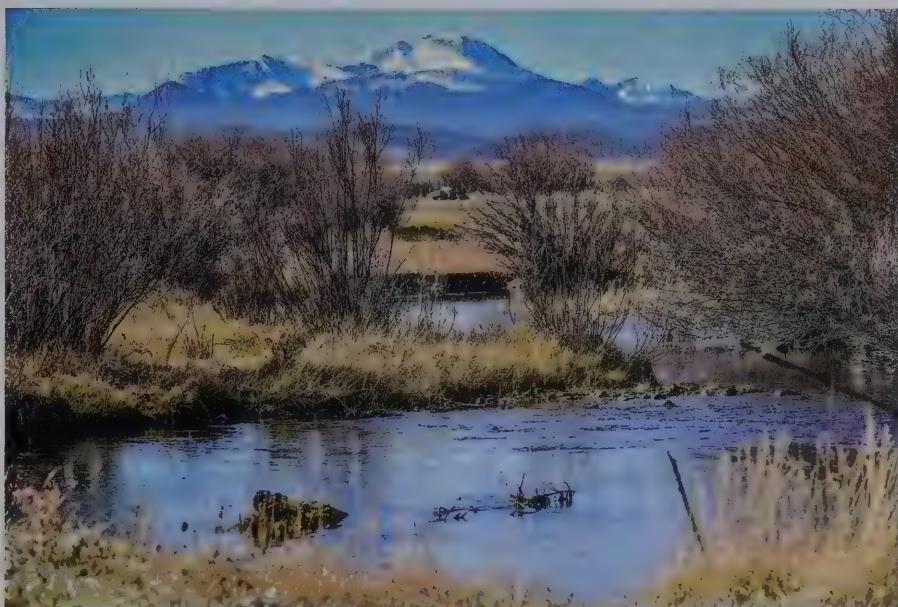
MORE PRECISE WATER USE

Upstream from Erb, near Jackson, Tom Mitchell walks along Governor's Creek, a Big Hole tributary, with his dog Gemma. The ranch has been in the Mitchell family for four generations. "I don't consider myself a rancher; I'm just here taking care of the ground," Mitchell says. He points to several projects that were part of the CCAA enhancement plan for his property, including newly planted willows anchoring the stream bank and a livestock tank where thirsty cattle can drink so they don't trample the bank trying to reach stream water. With a new screw gate, Mitchell can control water flow into his irrigation canals more precisely than he could with the old flashboard diversion gate it replaced, allowing him to leave more water in the creek.

On the Big Hole are 600 points of diversion—places where the river or a tributary goes through a gate, plank dam, or other device that controls water flow—and many are shared. Landowners open a gate and divert water from the main river or a tributary



WATER-SAVING DEVICE FWP riparian ecologist Jarrett Payne with a screw gate that allows landowner Tom Mitchell to more precisely control water flow from Governor's Creek (below), a Big Hole River tributary, than with the previous flashboard diversion gate it replaced.



into an irrigation ditch that feeds hayfields.

FWP's Payne says that throughout 2021, landowners in the CCAA worked together to keep as much water in the Big Hole as possible. It was harder for some than others. "There were painful conversations and tense decisions—decisions that were financially challenging for some people, especially when they needed to grow grass," he says.

Mitchell says his pastures never greened up. The summer rains between late July and Labor

Day that he remembers from his youth, which could shut down operations for several days, never came. But he kept to the plan. "I didn't want to be the guy drying up the river," he says.

Roughly 50 miles downstream, near Wise River, Sonny and Phil Ralston run a ranch that has been in their family since 1886. The almost total lack of rain last summer dried up their hayfields. But they too fulfilled their agreement to keep water in the Big Hole. The CCAA enhancement team helped them plant shade-

producing (and water-cooling) willows along a section of Deep Creek, which flows through their property before draining into the Big Hole. In addition, the team installed new fencing and stock tanks that keep cattle away from the creek. "This is proof that cows and streams can coexist," Payne says.

So can cows and grayling. According to Payne, the Big Hole population declined slightly from 2020, but the number of breeding adult fish contributing to the population was higher than average. "There's now around 1,000-plus breeding adult grayling in the Big Hole, a 168 percent increase since the CCAA first started," he says. "We're pretty happy with that, especially considering we had almost no precipitation last summer."

POST-GOVERNOR'S DECREE

In the nearby Ruby River watershed, about 75 landowners also left potential irrigation water in the river. The landowners hold contracts with the Ruby River Water Users Association that determine how much water they can use downstream of the dam on Ruby River Reservoir.

The DNRC owns the dam; management is handled by dam tender Bill Wood, who works for the association. "My primary role is to control the amount of water that comes out of the reservoir, deal with irrigators, and maintain minimum flows in the river for FWP," Wood says.

Low water in the reservoir last summer meant "we had to make cuts on how much water was allotted per contract" as water was released, Wood says. In the months that followed, when the situation didn't improve, irrigators and Wood communicated closely to figure out who would take water, and when, to ensure some was left for the Ruby's brown and rainbow trout. "It was a tough summer on irrigators and fish," Wood says.

And it came at a cost. Father and son ranchers Neil and Jake Barnosky could grow only about two-thirds of their typical annual hay crop. "We had to buy a lot of expensive hay," Jake Barnosky says.

Similar sacrifices were made by other contract holders, Wood says. "We are extremely fortunate we have a group of people who work well together. We could have dried up the river at any time."

This arrangement has roots dating back



SHARED SACRIFICE Jake Barnosky and his dad Neil Barnosky, who run a ranch on the Ruby River, worked with other landowners to give up water in 2021 to benefit trout. Below: The Barnoskys' headgate, used to take water from the Ruby for irrigation. Without those sacrifices, "there wouldn't be any trout in the lower end of the Ruby," says Matt Jaeger, the local FWP fisheries biologist.



nearly 30 years ago, when the reservoir and the Ruby River dried up in 1994. The governor's office intervened the following year with a consent decree calling for a drought-management plan with flow triggers.

Four bridges cross the lower Ruby River. The decree set a minimum flow of 20 cfs (cubic feet per second) at each bridge.

During the three times last summer when streamflow dropped below the decree's threshold at one or more of the

bridges, DNRC released additional water from the dam and landowners responded quickly by reducing the flow diverted by headgates up and down the river.

The governor's decree expired in 2002, but water users still voluntarily follow the plan and reduce irrigation withdrawals when the river drops too low, says Matt Jaeger, FWP's Beaverhead-Ruby program manager. "The reasons vary among irrigators, but my sense is that it's some combination of want-



THE GOOD OL' DAYS During years of abundant snowfall and steady rain, the Big Hole River and its tributaries flow steadily and the valley remains lush. But consistent drought there and throughout much of Montana has inspired landowners to save water to help save trout and grayling and keep cattle fed.

ing to avoid additional government intervention and valuing and taking pride in preserving the fishery," he says.

As low as the Ruby dropped in 2021, it could have been worse. "In previous years like this one, the river would have been dry," Jaeger says. He credits the water users with saving the fishery: "If they hadn't made sacrifices, there wouldn't be any trout in the lower end of the Ruby."

Elsewhere in western Montana, FWP has secured more than a dozen instream flow leases on critical fish spawning tributaries. Through these arrangements, landowners temporarily lease water rights to the department so that enough flow remains in streams during spring and summer.

Andy Brummond, an FWP water conservation specialist, says the leases are vital during droughts. "Sometimes you only need to protect 2 or 3 cfs for newly hatched trout to survive in a spawning tributary that's no wider than a sidewalk," he says. In addition to the FWP arrangements, Trout Unlimited and the Clark Fork Coalition lease instream rights on another 40 or so stream stretches across western Montana.

HOOT OWLS AND INSTREAM FLOW

Help for the Big Hole's grayling and trout also came from anglers and guides, who supported FWP regulations that closed fishing each day from 2 p.m. to midnight throughout the hot summer. These "hoot owl" restrictions protect salmonids already suffering from low oxygen levels in waters approaching 70 degrees from added stress.

Ryan Barba, co-owner of Sunrise Fly

"In Montana, we do wild trout management and rely on water to keep those wild fisheries healthy and productive."

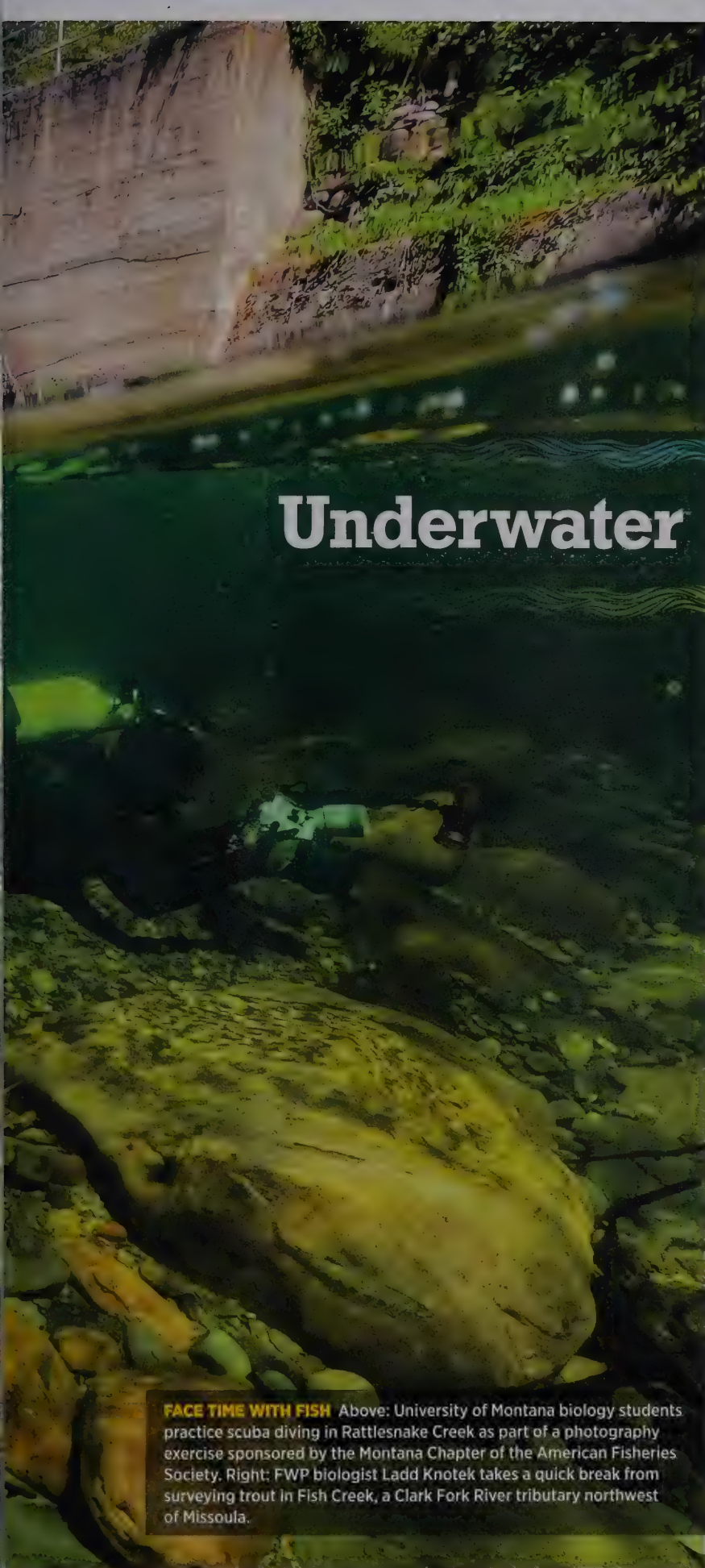
Shop in Melrose, has been guiding in the area for 16 years. Though drought and wildfires may have deterred some out-of-state anglers from booking trips, he says his overall business did not suffer much in 2021, even with the restrictions. The Big Hole

continued to flow, and anglers continued to catch fish in the cooler morning hours. "More water is being left in the upper Big Hole for the fish. The CCAA is definitely helping and working," Barba says.

Ryce, the FWP fisheries chief, says keeping more water in rivers and tributaries is essential. "In Montana, we do wild trout management and don't use hatcheries to produce fish for our rivers," she says. "We rely on water to keep those wild fisheries healthy and productive. That's why water conservation like what we're seeing on the Big Hole, the Ruby, and elsewhere is essential to the state's entire stream and river trout fishery operation."

Key to ongoing water conservation has been the work of watershed groups like the Big Hole Watershed Committee and Madison River Foundation, which bring together landowners, fisheries biologists, hydrologists, and nonprofits to build relationships and trust. "Those relationships sometimes take decades to build," Ryce says. "But over time they produce recognition of the universal benefits to all Montanans that come from water conservation—and the shared sacrifice required to make that happen." 🐾





Underwater Investigation

Freshwater snorkeling and scuba diving reveal the habits, habitats, and numbers of Montana's fish.

By Brianna Randall

Sunlight glints off an emerald-green pool in Fish Creek as a tall creature emerges from beneath the surface. Ladd Knotek spits out his snorkel and announces: "Five bigs, one brown, and a medium bull." Then he sinks back into the cold water to count more trout.

Knotek, a fisheries biologist with Montana Fish, Wildlife & Parks, has been snorkeling this Clark Fork River tributary each summer for 11 years. His underwater sorties help him take inventory of the fishery, which in turn helps FWP manage this popular trout stream, located 40 miles northwest of Missoula. ►►

PHOTOS: ROB ROBERTS

FACE TIME WITH FISH Above: University of Montana biology students practice scuba diving in Rattlesnake Creek as part of a photography exercise sponsored by the Montana Chapter of the American Fisheries Society. Right: FWP biologist Ladd Knotek takes a quick break from surveying trout in Fish Creek, a Clark Fork River tributary northwest of Missoula.





WHAT'S UP DOWN THERE? Left: FWP and Trout Unlimited biologists discuss their findings after a scuba survey of Fish Creek. Above: Spawning westslope cutthroat trout are visible in a western Montana tributary. Small streams like these can't be surveyed well with snorkeling, nor can powerful rivers like the Yellowstone and Missouri, which are too dangerous. Below: A recreational snorkeler on the Clark Fork River in downtown Missoula warms up before returning to look at bull trout.





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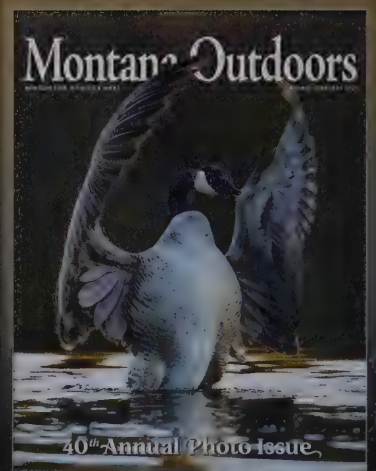
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Across the creek is a second snorkeler—Rob Roberts, a Trout Unlimited project manager—who scopes the number, size, and species of fish hiding beneath overhanging banks. Most are westslope cutthroat trout. Rather than stand up and remove his mask, Roberts holds up three fingers, followed by a thumbs-down sign. Snorkelers often use hand signals to increase efficiency. In this case: thumbs up for cutthroats over 12 inches (also called “bigs”), hand flat for fish 7 to 12 inches, and thumbs down for anything smaller than 7 inches.

On the bank, Reuben Frey, an FWP fisheries technician, records the snorkelers’ observations on a clipboard. In the largest pools, where dozens of trout swirl and scatter, Knotek and Roberts make several passes and average their counts.

This annual snorkel survey takes place in two different reaches, each about a mile long, which requires a total of nearly six hours in the water. Thus the dry suits. Even though it’s August, the water temperature in Fish Creek is an icy 55 degrees—perfect for native trout but freezing for humans. Even with protective gear, the snorkelers shiver during their lunch break in the warm summer sun.

ONLY SOME STREAMS

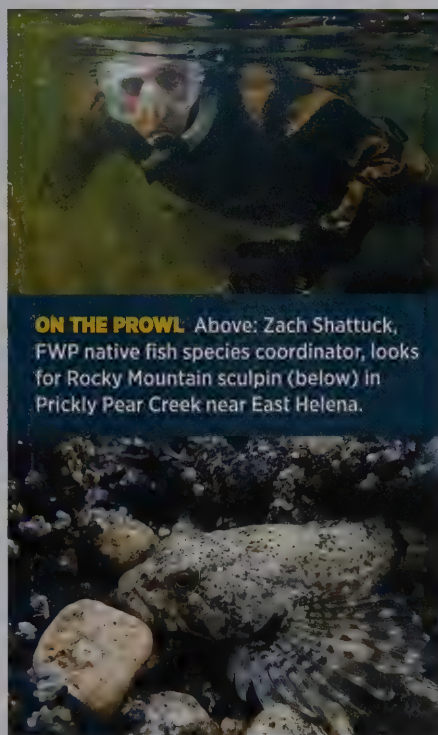
Knotek first donned a mask on Fish Creek in 2010 as a way to monitor how increased angling pressure and a habitat restoration project were affecting fish populations. Biologists usually use electrofishing to assess fisheries in Montana, putting a battery-powered wand in the water to send out a pulse of electricity that temporarily stuns nearby fish. When fish float to the surface, they’re weighed and measured, then released back to the stream. But shocking doesn’t work well in Fish Creek.

“It’s too sterile,” explains Knotek of the nearly transparent stream. “It’s almost like distilled water and doesn’t conduct electricity well. Plus, it’s so clear the fish see you and spook before you can get close enough to shock any.”

Only a handful of streams have the right conditions to make snorkel surveys feasible as a monitoring tool. Good underwater visibility is essential. Many streams and

rivers have too much sediment, vegetation, or algae, which can make it tough to see your hand in front of your face, much less trout hiding under logs. Then there’s size: Most creeks are too narrow or shallow to snorkel, and most rivers are too big and dangerous. Fish Creek is just right, containing deep pools that hold fish and gentle riffles that snorkelers can easily float over.

“
You also get information
on habitat use, behaviors,
and other aquatic animals
like freshwater mussels
and crawfish that you don’t
detect with electrofishing.”
”



According to David Schmetterling, who heads FWP’s fisheries research unit, one benefit of snorkeling is that it’s a lot easier on the trout, which don’t need to be shocked or handled. “You also get information on fish habitat use and behaviors, and on other aquatic animals like freshwater mussels

and crawfish—things you can’t detect with electrofishing,” he says. “And it’s one of the most fun things many of us biologists get to do in our jobs.”

The big disadvantage with snorkeling is that researchers can’t gather specific fish measurements or genetic samples, or implant radio transmitters to follow migratory movements and habitat use.

FWP biologists have been using snorkeling to survey fish populations for years. “We used it for studying bull trout migration and habitat use on the Clark Fork River after the removal of Milltown Dam, to view habitat changes,” Schmetterling says. “And we used it for a statewide crayfish project last summer.” FWP Aquatic Invasive Species Program crews also don snorkeling and scuba gear to look for non-native mussels and other unwanted aquatic animals and plants.

Fisheries biologist Nathan Cook, with the Montana Natural Resource Damage Program, recently snorkeled with a Clark Fork Coalition team to see whether trout are using specific habitat within the upper Clark Fork River Superfund cleanup area. “We were trying to sneak up on fish without disturbing them, to see what kind of habitat they were using. That’s something you can’t do with electrofishing,” Cook says.

He and two others snorkeled upstream of Deer Lodge to record—and ultimately map—the exact locations of fish in relation to overhanging vegetation or undercut banks.

SPECIALIZED SKILL

Snorkel surveys require specialized skills. “You have to be a good swimmer, know where fish are likely to be in a stream, correctly identify species, and estimate their size,” Cook says. “And you have to be able to do all that without spooking them.” It can also be dangerous, requiring snorkelers to navigate strong stream currents and hazardous logjams.

That’s why Knotek recruited Roberts to help out on Fish Creek. Roberts, who has snorkeled recreationally for 25 years, first used snorkeling at Trout Unlimited 15 years ago as a way to plan and assess the organization’s stream restoration projects.

After snorkeling the last stretch in Fish Creek, Roberts wades to shore and pulls back his hood. “Seems like numbers are way

Brianna Randall is a writer in Missoula.

TAKING THE PLUNGE

A diver enters the icy waters of the Middle Fork of the Flathead River. Cold, relatively sterile waters like these contain less organic material, making it easier for biologists to count fish and see which habitats they use.

down this year,” he says.

Knotek agrees. “All size classes are down, but the small and medium-sized fish are particularly low,” he says. “That’s likely because there’s less water and less habitat, or because it’s getting fished harder.”

Knotek explains that they would see more small or medium fish if increased mortality from overfishing was the problem. Anglers tend to catch the larger trout, and even though most fish are released, some die from the stress of being caught and handled.

Knotek suspects that low number were caused by the below-average flows of 2021. “Competition for space intensifies, with the bigger fish typically occupying the preferred or remaining holding spots,” he explains. “The small ones may have to relocate or migrate downstream, leading to reduced survival. And that may not bode well for adult trout numbers a few years from now.”

The snorkel survey also confirmed how few non-native fish (brown or brook trout), which can outcompete native species, have moved upstream from the Clark Fork. In

Fish Creek Snorkel Survey Results



YEAR	CUTTHROAT TROUT			MOUNTAIN WHITEFISH (All sizes)	BULL TROUT (All sizes)	OTHER TROUT (All sizes)
	Juvenile (<7 in.)	Sub-adult (7-12 in.)	Adult (>12 in.)			
2009	146	140	123	168	3	7
2010	261	105	141	205	5	21
2011	202	168	117	200	10	24
2014	278	162	216	257	5	38
2017	367	288	294	155	5	20
2021	57	96	162	169	6	14

addition to the westslope cutthroats, the stream contains several native sculpin species as well as mountain whitefish and the federally threatened bull trout. This year, the snorkelers found six bull trout, all sub-adults roughly 14 to 18 inches long, in the two reaches they surveyed, similar to surveys in previous years.

As the Fish Creek survey crew members

return to their pickup, Knotek gestures toward a lone trout angler, his fly line glistening with each cast in the slanting afternoon sunlight. “I’ve handed my mask to anglers on past snorkel surveys to let them look in the pools,” he says. “It’s exciting for them to see all those fish down there. But it’s also humbling when you realize you weren’t able to catch any.” 🐟

SNORKEL MONTANA



Snorkeling is a simple, inexpensive, and novel way to enjoy watery worlds. And it's not just for exploring coral reefs. People snorkel in freshwater rivers, streams, and lakes, including many in the Treasure State. "Montana has amazing snorkeling spots right in our backyard waters," says Zach Shattuck, FWP native fish species coordinator.

Shattuck has snorkeled rivers and streams since the mid-1990s. He especially enjoys flipping over underwater rocks to look for small critters like sculpins or watch caddis flies build their tiny casings of sand, sticks, and silk. "I get a kick out of bigger fish, too," he says. Shattuck has hovered over hundreds of spawning white suckers and watched Arctic grayling cruise past his mask, their tall dorsal fins swaying in the current. He says the prairie creeks in eastern Montana have the state's greatest fish diversity. "That's where you see chubs, sticklebacks, dace, darters, shiners, and other species most anglers in this state don't even know exist," he says.

The wonders go beyond fish, too. Shattuck sees frogs, toads, crawfish, mink, musk-

rats, otters, and all sorts of waterfowl. Once he floated past a moose drinking from the stream, unaware of his presence.

Montana Outdoors editor Tom Dickson snorkels Spring Meadow Lake in Helena in late summer when the water warms. "As you float over a 30-foot drop-off, you feel like you're flying," he says.

Hal Herring, a writer in Augusta, has been snorkeling since he was a kid growing up in Georgia. "Lakes are the most relaxing waters, but big rivers are really fun if you don't mind getting a bit beat up," he says.

Herring says snorkeling gives him an "almost unfair" advantage when he swaps his mask for a fishing rod. "You see right where they are and discover how fish really operate. It's as close as you can get to becoming a fish."

Herring adds he'd like to see more people snorkeling because it instills a love for rivers and the desire to protect them. "It's truly an immersive experience," he says. "If more people experienced water this way, it would create an army of advocates for our rivers who would never back down." ■

KID FRIENDLY Snorkeling is a fun way for families to explore their local waters. It's inexpensive, easy, and accessible.



DIVE IN

Where to go

Get a safe start by snorkeling small, clear streams no wider than 10 feet, or slow spots in bigger rivers. Ponds and small lakes also make great, safer snorkeling spots. Use FWP Fishing Access Sites as easy entry points.



Safety

Wear a life vest, and wading shoes to protect your feet. Don't venture out in high water, and stay away from rapids and logjams. It's safest to snorkel with a buddy or two. That also allows you to do a shuttle, leaving one vehicle downstream where you will exit the river or stream.



Comfort

Snorkel in late summer when the water is warmest, especially when exploring trout streams. Wear a tight-fitting merino wool or polypropylene top to keep from getting chilled. Keep warm, dry layers handy to change into afterward.



Gear

A mask and breathing tube costs just \$35 at major outdoor retailers. If you catch the snorkeling bug, consider investing in a neoprene bodysuit, booties, gloves, and hood.



In the water

Ease in slowly and tread lightly (or not at all) to avoid stirring up sediment. Float calmly and slowly so the fish don't spook. Hold rocks to slow yourself down, and peek beneath rocks and under overhanging banks as you pass by. ■



Carping about fishing

By Tom Dickson

Not long ago while shopping for lures in a Missoula sporting goods store, I overheard two anglers griping about the lack of walleye fishing opportunities in western Montana.

"We have to drive halfway across the state," grouched one guy.

"Where I'm from, we've got walleye pretty much everywhere," said the other.

Though tempted to respond, I bit my tongue, moved off, and considered their complaint.

Griping is second nature to every angler

Anglers like to complain, and often we have unrealistic expectations. That's mainly because most of the time while on the water we aren't catching fish. Those long hours of frustration tend to build up.

So, I understand those two guys. But only to a point.

The fact is, you can't have every type of game fish everywhere you live. I'm sorry, Glasgow anglers. You've got Fort Peck Reservoir, one of the best warmwater fisheries in North America, right out your back door. You can't also have a great trout river like the Madison or the Big Hole there, too.

The landscape is just too different.

Same with you, western Montana anglers. Despite your complaints, FWP is not about to stock walleye on your side of the Continental Divide. That wise decades-old policy protects existing trout, perch, and other fisheries vulnerable to yet another finned predator. Not only would the addition of walleye be biologically irresponsible, it would be unfair to anglers currently enjoying existing fisheries.

Besides, driving from Missoula to Canyon Ferry Reservoir, the nearest walleye fishery, is not like making a cross-country expedition. It takes two hours.

I grew up in Minnesota, the self-proclaimed walleye capital of the universe. Most North Star State anglers live in the Twin Cities and regularly drive two, three, four, or more hours each Saturday morning to reach decent walleye waters—few of which, by the way, can hold a candle to Canyon Ferry.

In Minnesota, a 22-inch walleye is any

angler's catch of the year. A 28-incher shows up every few seasons on the evening news under the banner "Veteran Guide Lands Fish of a Lifetime." The first spring I lived in Helena, the *Independent Record* reported walleye of 30 and 31 inches caught at Canyon Ferry—one by a 12-year-old boy. A few years ago, a fellow I work with caught a 30-incher there *from shore*.

As for catch rates, those in Montana walleye reservoirs regularly top those in most Midwestern waters, including legendary Lake Erie. I didn't hear those guys in Missoula talking much about that.

The fact is, we Montana anglers have it good. The trout fishing is off the charts. In addition to our dozen world-renowned blue-ribbon rivers, the Treasure State is home to a half-dozen reservoirs like Holter and Hauser where stocked rainbows regularly reach 22 to 24 inches. An angler can explore 28,000 miles of other streams and rivers if the Gallatin, Bitterroot, or other popular waters get too crowded. And 1,000-plus high mountain lakes hold trout so eager to bite they even make me appear skilled.

Then there's our incredible warmwater fisheries. Montana is home to a dozen walleye reservoirs, as well as topnotch bass fishing on Noxon Reservoir, the lower Yellowstone River, and 10 or more reservoirs on either side of the Continental Divide. We can fish for channel catfish on hundreds of miles of river, northern pike and tiger muskies on a half-dozen lakes, and crappies and sunfish on hundreds of urban and prairie ponds that FWP stocks each spring.

You can learn more about these and other angling options on the FWP website or the department's free FishMT app.

As for my fellow anglers so hugely dissatisfied with the fishing here? I suggest you head back to Minnesota, California, Texas, or wherever and fish there for a few years. If the angling is better, please drop me a line.

I've got a hunch no one will take me up on my suggestion. We anglers like to gripe, but deep down we know a good thing when we see it. 🐟

HEY SIRI, WHAT ARE THE WALLEYE TAKING RIGHT NOW?



I know. The fish should be bigger, more abundant, and more willing to bite. FWP should post hourly updates on every reservoir and river telling anglers exactly where the fish are hiding and what they are eating.

I made up that last one, but it's not far off.

Tom Dickson is the Montana Outdoors editor.

Northern pocket gopher

Thomomys talpoides

By Julie Lue



SCIENTIFIC NAME *Thomomys* is a combination of two Greek words meaning "heap" and "mouse." *Talpoides* is Latin for "molelike."

When spring arrives and snow melts off the hill behind my house, I find tubelike castings of soil, like giant snakes, lying on the ground, and I stumble over crescent-shaped mounds of dirt between clumps of bluebunch wheatgrass and arrowleaf balsamroot. These signs tell me I have a resident northern pocket gopher.

But I have never seen a gopher. Not one.

Sure, I've seen hundreds of those cute little colony-dwellers that stand next to their burrows, watching for danger. I used to think they were gophers. But they're not; they're ground squirrels, usually one of four species—Wyoming, Uinta, Richardson's, or Columbian—that can be tough to tell apart. I've also seen those larger, chunkier rodents with short tails that live in denser colonies called "towns." They're prairie dogs, either black-tailed or white-tailed, both state species of concern.

Montana's actual gophers—the northern and Idaho pocket gophers—are much harder to see. They spend most of their lives tunneling in the dark. Their soil mounds and "snakes" might lead you to suspect the presence of moles, but no moles live in Montana.

APPEARANCE

Northern pocket gophers are stocky rodents, 8 inches long and usually weighing about 3 to 5 ounces, with a cylindrical body and a short, sensitive tail that helps them navigate while backing up in tunnels. Their fur, reddish-brown on top and grayish below, is soft and pliable, and their skin is loose, allowing

them to turn around more easily in tight quarters. Pocket gophers have small eyes and ears, and they can close their lips behind their large incisors, which they use for digging, along with long front claws. The species' common name refers to their fur-lined cheek "pockets," which are used to carry food and bedding.

RANGE AND HABITAT

Northern pocket gophers' range includes much of the western United States, including all of Montana, and parts of western Canada. They live as far north as central Alberta and as far south as central New Mexico. The rodents prefer areas with deep soils where tunnels will hold their shape and not become waterlogged or flooded. They live at almost any elevation, including alpine areas.

FOOD

Pocket gophers mostly eat the underground parts of plants—bulbs, corms, and roots—which they access through their tunnels.

BEHAVIOR

The anti-social pocket gopher does not share its burrow except during breeding season, when the female allows a male to visit. After a gestation period of just under three weeks, she gives birth to four or five young, which will be independent and out of the burrow by two months.

A lone pocket gopher's tunnel system can stretch hundreds of feet. It digs a vertical tunnel every so often for discarding soil,

creating crescent-shaped mounds. It plugs the entrance with dirt to keep weasels and other predators out. Various chambers in the burrow are used as a nest, food cache, and latrine. In winter, the pocket gopher also burrows through snow and jams loose soil from underground into the snow tunnels. This creates the castings visible after snowmelt.

Though pocket gophers can damage gardens, lawns, crops, and orchards, they often improve plant diversity and productivity. The rodents till, aerate, and incorporate organic matter into soil. On the alpine tundra, "gopher gardens" are known for their spectacular wildflower blooms, including the bluish-purple sky pilot.

Pocket gophers, which do not hibernate, remain active year round.

A pocket gopher's urge to dig is strong. Kerry Foresman, professor emeritus of biology at the University of Montana and author of *Mammals of Montana*, says that when live-trapping shrews in pitfall traps—coffee cans recessed into the ground—he also captured many pocket gophers. "They never attempted to stand up and climb out of the can, which they were large enough to do, but rather continued to try and dig out through the bottom," he says. He released them unharmed.

CONSERVATION

In Montana, the northern pocket gopher is considered common, and in some situations, a pest. The similar-looking Idaho pocket gopher, a potential species of concern, has been observed in parts of Ravalli, Beaverhead, and Madison counties. 🐾

Julie Lue is a writer in Florence.

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